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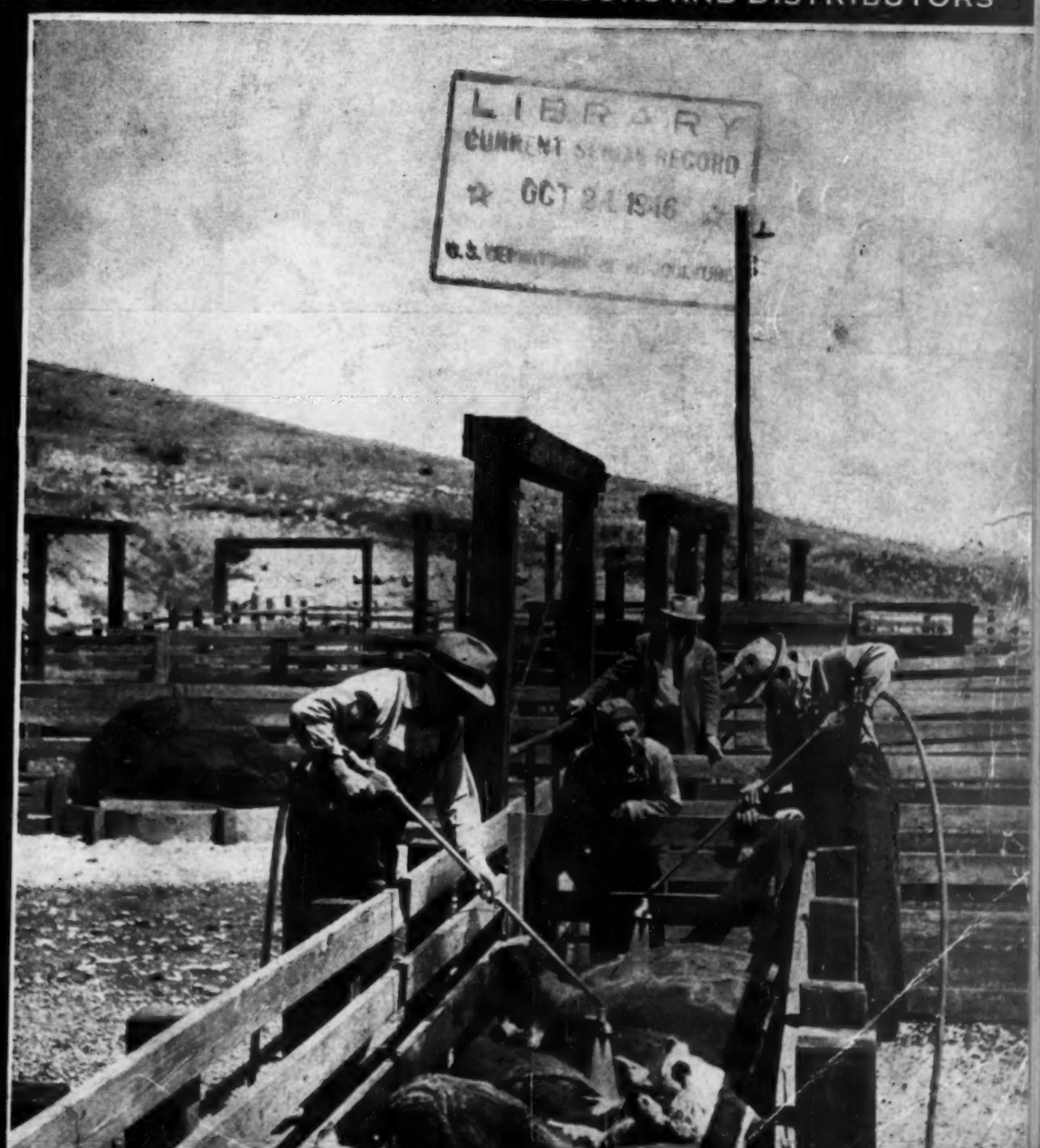
AGRICULTURAL CHEMICALS

A MONTHLY MAGAZINE FOR MANUFACTURERS, PROCESSORS AND DISTRIBUTORS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AGRICULTURAL CHEMICALS

THIS MONTH'S COVER

Spraying cattle with DDT for control of flies. Work is done in narrow alley to prevent excessive movement by animals and consequent waste of insecticide. Spraying in left foreground is Ray L. Cuff, regional manager, National Livestock Loss Prevention Board, Kansas City. Manning the other sprayer is Dr. E. W. Laake, Bureau of Entomology, U.S.D.A. (Photo courtesy of John Bean Mfg. Co., Lansing, Michigan.)

OCTOBER, 1946
Vol. 1 No. 6

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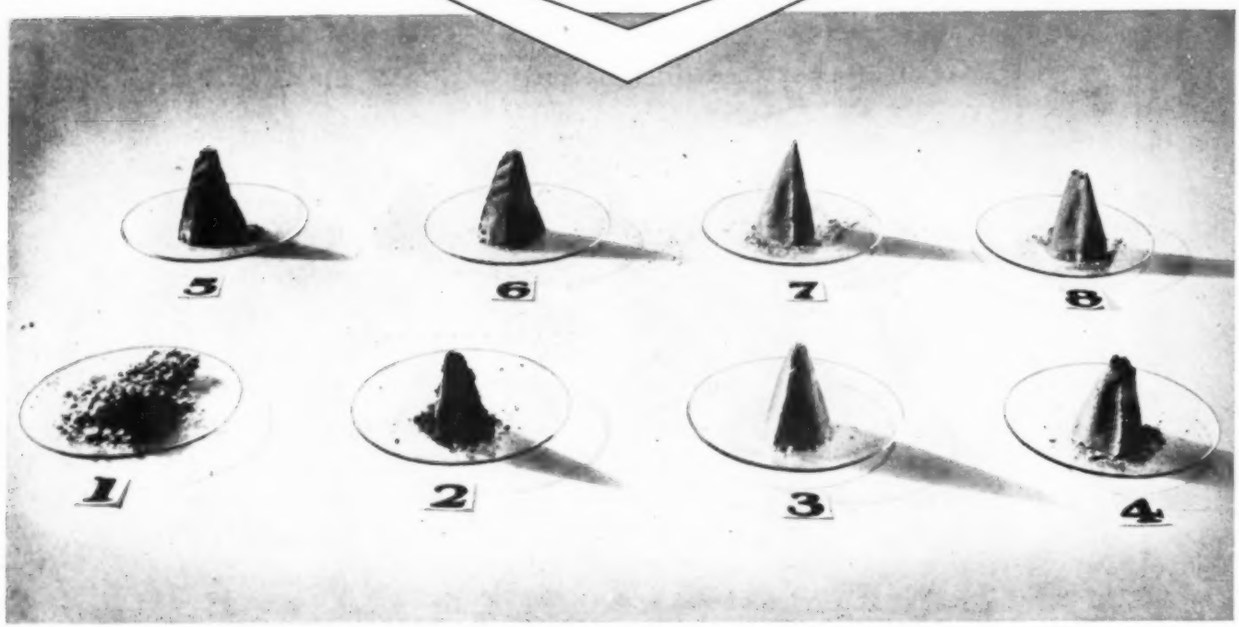

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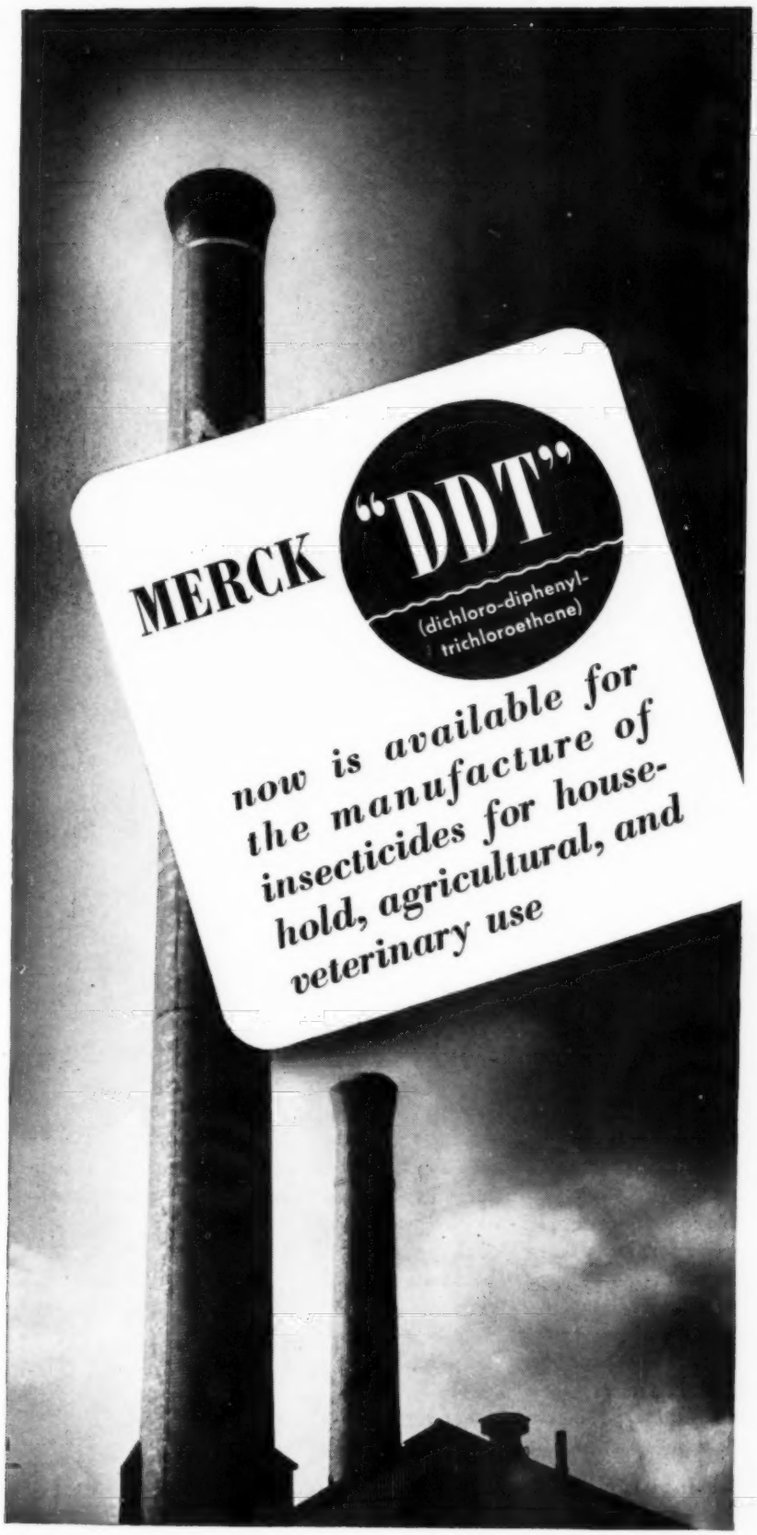
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AGRICULTURAL CHEMICALS

CONSISTENT with an announced policy of presenting each month timely editorial articles, the publishers of Agricultural Chemicals are constantly searching for more features of an interesting nature.

As a result, dozens of features have been arranged for subsequent issues of the magazine.

Here is a partial list of some articles which will make an appearance within a short time:

"Chemical Seed Treatments"
"Fumigation Methods"
"Manganese as a Plant Food Constituent"
"Hexaethyl Tetraphosphate"
"Insect Repellents"
"Dust Drift and Bee Survival"
"Dormant Sprays"
"2-Bis Dithiocarbamates in Control of Fruit Diseases"
"Cryolite Insecticides"
"Fertilizer Trends"
"Resumé of DDT for Agriculture"
"Citrus Fumigation"
"Blending Dust Insecticides"
"Fixed Coppers in Treating Vegetables"
"Soil Fumigants"
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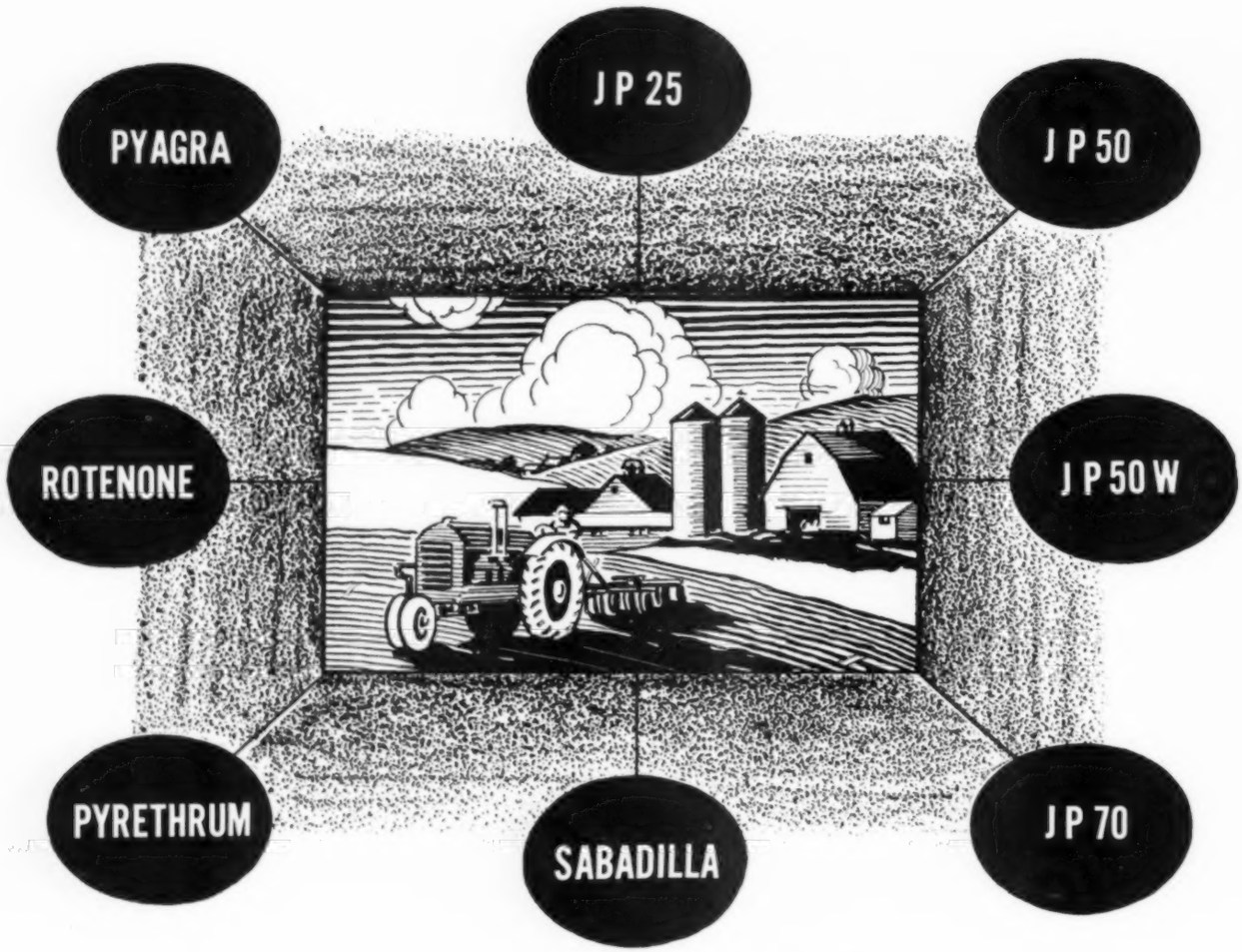

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THE EDITOR COMMENTS

EXTREME need for care and cleanliness in handling and applying most agricultural chemicals is emphasized by an unfortunate happening in Indiana last month. A local spraying contractor treated a pasture with 2,4-D. Shortly thereafter, eleven head of cattle grazing in the area died. Suspicion immediately fell on the weed killer. An examination of the animals' stomachs, however, showed arsenic in lethal quantities. Arsenic was also found on the sprayed foliage of the pasture, and it was concluded that arsenic and not 2,4-D had caused the deaths. Investigation disclosed that the spraying rig had previously been used to treat foliage with arsenate of lead and that the tanks and hoses had not been thoroughly cleaned prior to filling with the weed killer.

On its face, a case of this kind may be judged in one way only,—the blame lies on the contractor who was grossly careless or ignorant. If he were ignorant, he had no right to do the work he was doing. But the damage and responsibility go beyond this one man. A product, once unfairly stigmatized, may never regain local confidence especially in farming communities where such happenings are often distorted and the truth obscured in neighborhood gossip.

Where a manufacturer, distributor, local processor or spray contractor may find his business threatened with damage by unfortunate accidents at any time, the degree of his responsibility is great. And the practical as well as moral considerations are important. Careless and improper use, including the obvious danger of contaminated equipment, are potential pitfalls for the product as well as the user. As new chemicals come along, the problem grows larger and more complex. Chances of error become more numerous unless the factor of human carelessness is reduced.

Basic solution of the problem would seem to be broadened education,—plus more label warnings, more booklets and tags attached to containers,—and wider-sought government agency and dealer help. In such an effort, everybody from the manufacturer to the ultimate user has a stake. Inasmuch as the problem is posed mostly by human carelessness, the answer is education, and more education.

HEAVY shipments of ammonium nitrate abroad to occupied countries during the past two months, and further anticipated shipments during the next two months, may seriously embarrass fertilizer manufacturers in this country early next year if the nitrate is not replaced and made available promptly to manufacturers by the government! According to F. S. Lodge of the National Fertilizer Association speaking before the American Chemical Society recently, the replacement of these current heavy exports, which has been promised by the end of next April, will be too late for most 1947 domestic needs unless the bulk of it is received well before that time. And should exports be materially reduced or suddenly cease, a surplus would be quick to develop.

If all goes according to schedule, nitrate to replace government "borrowing" is likely to be available for fertilizer mixing and shipment to most areas in time for spring planting. But when government is part of a picture, things have a bad habit of not going as per schedule. Being sorry next April cannot hold back spring planting.

The fertilizer manufacturer is quite definitely and inadvertently in on a big gamble, just as is American agriculture. At the same time, if shipments to occupied countries are reduced, as they well could be with present foreign policy uncertainties, the gamble for American manufacturers in the other direction would be as great if not greater. And until the government is wholly out of the fertilizer business, this, we feel, is a sample of the uncertainty with which the fertilizer industry and the farmer and growers will be constantly faced.

Guest Editorial written especially for this issue of Agricultural Chemicals.

Prosperous Agriculture is based on free enterprise

By Clifton A. Woodrum*

President, American Plant Food Council, Inc., Washington, D. C.

YOUR Government in Washington, by and large, is just about what you have made it. If there are men in Congress or in the departmental services whom you feel are unqualified or unworthy, they are usually there because some constituency has been neglectful.

It is appropriate, indeed, to repudiate those men who have served you ill; likewise, it is of equal, if not of greater importance, to give active support to those who are serving you conscientiously. Men who would preserve our system of free enterprise cannot pass up their responsibilities for Government by merely crying "demagoguery" or "bureaucracy."

Let us not forget when we speak of "demagogues" and "bureaucrats," we must be a little discriminating. The great wartime achievements in production, our accomplishments thus far in peace did not come to pass without there being some intelligent leadership in Washington. It was not just an accident. America's great contribution toward the winning of the war was made possible under a system of free enterprise and under an economy of abundance. And if peace is to be assured, we must support and encourage those individuals who "stand watch" over the system which has been largely responsible for the winning of the war and which will have a major role in preserving the peace.

Viewing the wartime record of the fertilizer industry in an address before the American Plant Food Council convention, Mr. A. W. Minor, Assistant to the Secretary of Agriculture, said:

"Your performance during the war indicates that you are equal to almost any task. Your increases in production were phenomenal. They permitted great increases in consumption of fertilizer on the farms. Use of nitrogen increased from a prewar average of 371,000 tons to a total of 640,000 in 1945. Consumption of P_2O_5 went from 720,000 tons to 1,368,000. Use of K_2O increased from 375,000 tons to 746,000.

"You did all this in the face of undoubtedly the greatest difficulties you have ever encountered . . . and you earned the sincere compliments

(*Turn to Page* 43)

* *Mr. Woodrum was a member of the U. S. House of Representatives from Virginia for 23 years. Resigned Jan. 1, 1946, to become president of American Plant Food Council, Inc.*

AIFA Holds 13th Annual Meeting at Spring Lake

THE Agricultural Insecticide and Fungicide Association held its thirteenth annual meeting September 3, 4 and 5 at the Essex and Sussex hotel, Spring Lake, N. J. A record attendance of over 150 was on hand to hear a series of talks which reviewed new developments in the field, reported association activities, and pointed out general trends in the industry.

Four new names were added to the Association's Board of Directors at the meeting. They are W. C. Bennett, vice-president of Phelps-Dodge Refining Corp., New York; James McConnon, vice-president of McConnon & Co., Winona, Minnesota; E. H. Phillips, vice-president in charge of purchasing for Co-operative G.L.F. Soil Building Service, New York, and Fred G. Shaneman of Tacoma, Washington, vice-president of Pennsylvania Salt Manufacturing Company, Philadelphia, and president of Pennsylvania Salt Manufacturing Company of Washington.

One of the keynote addresses of the meeting was delivered by Dr. F. C. Bishopp of the Bureau of Entomology and Plant Quarantine of the U. S. Department of Agriculture. His talk, entitled "Preliminary Results of Tests of Some of the Newer Insecticides"* pointed out the tremendous amount of research necessary to determine the effectiveness and characteristics of a given insecticide, and cited numerous examples of successful control measures with various pests in the agricultural field. He reviewed control results with a number of relatively new insecticides, emphasizing the fact that these findings are purely preliminary.

Dr. Bishopp warned his hearers not to believe that any one insecticide can be a cure-all in itself. "No one insecticide will kill all types of insects," he reminded the group, and added that the more complicated formulas will require specialized equipment for application, specially-trained men, and correct timing of application to do a thoroughly efficient job.

Other speakers included men prominent in technical, legislative, and consumer fields. In the latter category was Ray L. Cuff, of the National Livestock Loss Prevention Board, Kansas City, who described the efforts of cattlemen in the southwest to rid their herds of insect pests through use of DDT. He pointed out that extensive tests in Kansas, Texas and Missouri have shown that it pays well to treat cattle with DDT. "More than a million head of cattle in two southwestern states have been treated," he said. "The results showed that these treated animals gained about 50 pounds apiece during the summer." The gain in weight amounted to about a half pound per day per animal, he said.

One pound of technical DDT, efficiently applied, will add from 1,200 to 2,300 pounds of beef to a herd. Mr. Cuff stated further that stronger concentrations of insecticide do a much more thorough job than ordinary proportions. The added residues kill lice as they hatch and save the rancher the work and expense of rounding up his herds frequently. In summing up his remarks, Mr. Cuff reminded the association that when cattle are untreated for parasitic pests, too much of the animal's feed is consumed in nourishing thousands of flies and lice.

Dr. D. O. Hamblin of American Cyanamid Company presented a paper dealing with "Toxicology," describing the numerous considerations involved in determining the toxicology of insecticides and fungicides, and pointing out the extent to which medical science goes to find the truth about toxicity. The cost of experimental animals was brought out . . . the care and vigilance necessary in growing such animals, and the problems involved in determining human reactions to various preparations. The paper was read by Dr. Arthur F. Mangelsdorf of American Cyanamid Co. in the absence of its author, Dr. Hamblin, medical director of the company.

Farm Economics Stressed

CLIFTON A. WOODRUM, president of the American Plant Food Council, spoke on "The Private Enterprise System." The similarity of purpose between the AIFA and his own fertilizer association was pointed out, inasmuch as each is dedicated to the service of American agriculture. Mr. Woodrum stated that we can have no stable economy unless agriculture is on a self-sustaining, self-supporting basis. He termed it a "disservice" to the farmer to build up the idea that

* Full text of Dr. Bishopp's appears elsewhere in this issue.

the government owes him a living, or that he can gain any headway by not working. The American farmer, he said, wants no tin cup for alms. He wants a fair and square chance to earn his way. "American agriculture is becoming more and more fertilizer and insecticide conscious," he said, and continued that the farmer has learned that scientific application of modern plant food and pest control materials enables him to produce more.

Mr. Woodrum urged the AIFA to make its voice heard in government. "The prime duty of American business is to make its influence felt in government from local and state matters to the Congress in Washington," he stated.

George Krieger, Chairman of the Agricultural Development Committee of the American Petroleum Institute told the group of the work of the Committee, stating that its members are selected from different sections of the country in order that a full and comprehensive appraisal of sectional problems may be available. He stated that in the opinion of the Committee, scientific power farming is in its infancy. He added, however, that all such developments must be soundly based on economic principles of earning profits.

The story of how the California Economic Poisons Law operates was told by Allen B. Lemmon, Chief of the Bureau of Chemistry of the State. He reviewed the history of the regulatory laws which had their beginning early in the century, and followed the development up to the present time. He pointed out the enormous dollar value of California's citrus crops, and stressed the importance of enforcement of laws regulating economic poisons in that area. The degree of vigilance necessary to guard against "crackpots" with high-sounding ideas of super-plant growth and cure-all insect and disease controls was described by Mr. Lemmon who said that his state seems to have its full share of persons wtih unconventional notions.

The Hon. Willard H. Allen, Secretary of Agriculture of the State of New Jersey emphasized the importance of a sound agriculture to a nation in peace as well as in war. He reminded his hearers how fortunate this nation is to have been able to feed itself and its armies during the late war, as well as furnishing aid to its allies. As a military policy, national agriculture must be strong, or the entire country will be vulnerable, he stated. A hungry country is a defeated country, he said, and cited numerous historic instances where this had proved true.

Agriculture in peacetime has a direct bearing on the economic standing of the entire nation, the Secretary stated. Rural sections and small towns must be prosperous to form a backbone of economic security for the urban centers.

"Bugs and Bureaucrats" was the title of a talk by Edward R. Eastman, editor of *American Agriculture*. Mr. Eastman commended the industry for its alertness in keeping pace with

Radio Reports

National attention was focused on the Spring Lake meeting of the AIF through radio stations WEAF and WJZ, New York, each of which made recordings of parts of the meeting. WEAF made transcriptions of the voices of Mr. and Mrs. Ray Cuff, R. B. Stoddard, president George F. Leonard, and Ernest Hart. Recordings were made by WJZ of remarks by Mr. and Mrs. Cuff, E. R. Eastman, Dr. F. C. Bishopp and Dr. S. A. Rohwer.

In addition to the transcriptions, a special summary of the entire meeting was prepared by Don Stetson of the AIF Association for the National Networks and four key radio stations in the east. The programs were scheduled for broadcast at later times by the stations concerned.

Introducing Four New

new problems of pest control. Insect populations seem to have increased in the past years, he stated, and still the industry has been able to keep the infestations well under control with new and better means. He reiterated the fact that despite amazing developments, there is still no single cure-all in the insecticide and fungicide field.

Looking on the national scene, Mr. Eastman stated that scores of circumstances indicate that the country is governed by bureaucrats rather than by duly elected representatives of the people. He deplored what he termed a departure from sound economic policies and from the fundamental principles on which the United States was founded, and added that agriculture cannot be happy until the nation returns to such principles.

Winners of the AIF Golf Tournament*

1. **R. Wotherspoon**
   Orbis Products Co.
2. **Thomas McCormack**
   E. I. duPont de Nemours & Co., Inc.
3. **Friar Thompson**
   R. J. Prentiss & Co.
4. **Edward H. Phillips**
   Coop. G.L.F. Soil Bldg. Service, Inc.
5. **Melvin Goldberg**
   Geigy, Co., Inc.
6. **W. F. Hall**
   Chipman Chemical Corp.
7. **Thomas Morgan**
   MacNair-Dorland Co.
8. **R. Zipse**
   Geigy Co., Inc.
9. **John Rodda**
   Dodge & Olcott, Inc.

* Scores were computed under "Shawnee Handicap System" by which handicaps were given on basis of subtracting from gross score the strokes used on the worst holes. The higher the gross score, the more strokes were allowed, giving all players opportunity for awards.

Leonard Presides

EACH of the three day sessions was under the chairmanship of George F. Leonard, president of the AIF Association. Various committee reports were presented by the respective chairmen, each of whom reported definite progress in solving problems in his field. Executive Secretary Lea S. Hitchner spoke briefly, pointing out the over-all gains made by the association during the past year, and gave a brief resume of activities entered into by the group.

Dr. L. Gordon Utter of Phelps Dodge Corp. reported the progress of the recently re-organized technical advisory committee. He announced the personnel of the committee, and outlined the aims and purposes of the group.

Report of the Membership and Information Committee was given by Ernest Hart of Niagara Sprayer and Chemical Division of Food Machinery Corporation. Mr. Hart announced the names of new members of the Association and gave each an official welcome. He brought out the success of the Association's public relations program, revealing the manner in which numerous publications have carried industry news to the public.

Work of the Association's Legislative Committee was described by L. L. Hedgepeth of Pennsylvania Salt Manufacturing Co. who told of the many problems faced by the committee. He said that the group welcomed the opportunity of taking part in drafting of a model State Economic Poison Act which has been presented through the National Association of State Commissioners, Secretaries, and Directors of Agriculture. The chairman also reviewed the committee's organization, its policies and duties, and looked ahead to the tasks yet confronting the Association as regards legislative matters.

For relaxation from the serious considerations of the convention, the annual AIF golf tournament was held Wednesday afternoon, with eleven foursomes entered. Nine prizes were awarded at a stag dinner.

AIF Association officials indicate that the thirteenth annual meeting was the best ever held from the standpoint of registration, attendance and the numbers present at the business sessions. ★★

Association Directors

With the camera at AIFA golf tourney

Although serious business sessions took up a major portion of the convention time, allowance was made for a period of relaxation on the Spring Lake Golf Course. Here are seen a number of the players prior to teeing off.

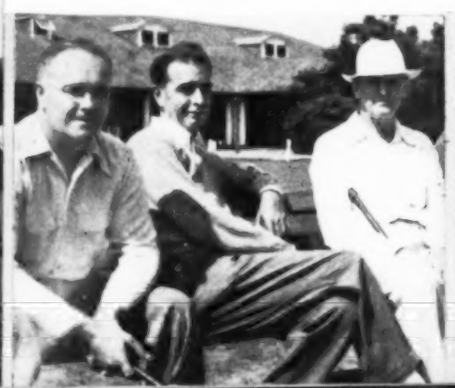
On the left hand, top photo, is Jack Miller of Atlas Powder Co. and Friar Thompson of R. J. Prentiss Co. In the photo below this pair are seen J. J. Shafer of B. G. Pratt Co., John A. Rodda, Dodge and Olcott, Inc., and Melvin Goldberg of Geigy Company, Inc. At the lower left are "Cap" Palagonia of Orbis Products Corp.; Ted Riedeburg of Westvaco Chlorine Products Corp., and Dr. J. B. Skaptason of John Powell & Company, Inc.

At the lower center are Edward H. Phillips of the Co-op. G.L.F. Soil Building Service, Inc., R. B. Stoddard of Dodge & Olcott, Inc., and John V. Vernon of Niagara Sprayer and Chemical Division, Food Machinery Corp.

Lower right shows Jack Miller again, with Edwin J. Camson of Orbis Products Corp., J. G. Brunton of Pennsylvania Salt Manufacturing Co., and A. W. Baeder of Sherwin-Williams Co.

Right center photo shows Ray Byrnes of Rohm & Haas Co., H. W. Feuchter of J. T. Baker Chemical Co., J. L. Batty, Co-op. G.L.F. Farm Products, Inc., and Thomas Morgan of Agricultural Chemicals Magazine.

Top, right, depicts Paul Mayfield of Hercules Powder Co. M. L. Somerville of Sherwin-Williams Co., B. H. Jones of Sunland Industries, Inc., and Joseph B. Cary of Niagara Spray-Chemical Division, Food Machinery Corp.



New Insecticides

A progress report on results being obtained in preliminary test studies*

By F. C. Bishopp

Assistant Chief, Bureau of Entomology and Plant Quarantine, U. S. Dept. of Agriculture

DURING the war years we have witnessed the appearance of several new and amazingly effective insecticidal materials. DDT was the fore-runner, at least in this country, of these discoveries. Even after nearly four years of intensive research and practical testing much remains to be learned about this valuable insect killer. This serves to illustrate the time and effort required to indicate, even in a general way, the place that a new material may take among the weapons being used against insects.

No insecticide yet discovered is highly effective in killing all kinds of insects. This specifically makes it necessary to determine, first, the efficacy of the material and of its components against a wide range of insects; second, what effect various accessory materials and other modifications of formulations have on its toxicity; and third, what combinations with other insecticides may be made to increase toxicity to given insect species or to reach other pests not effectively controlled by the material in question. The initial testing in the first category takes much time and in the case of DDT, for example, the second phase is not yet complete and the third has just begun.

After the initial determination that a material possesses marked insecticidal value, investigation of the chemical and other manufacturing problems logically proceed. Under our present-day way of evaluating an insecticide, studies of the toxicity of the material to higher animals, to plants, and to various beneficial forms of life promptly follow.

I feel that few people appreciate the complexity and number of problems involved in insect control and in the development of an insecticide. The general public must be brought to realize that there are a tremendous number of different kinds of insects (probably 50,000 injurious ones) and that these may differ as much in their appearance, place of abode, and habits of life as a man and a monkey or as a cow and a chicken. As a matter of fact, they differ far more. For example, we find the young of an insect such as the cicada living down two feet in the soil while the adults spend their lives in trees; the wiggler of the mosquito spending its life in water while the adult flies freely about feeding on man or livestock. Certain insects in some stage live but a single day while others live for many years. Some insects are exposed during the major part of their lives while others burrow about in the narrow space between the two surfaces of a leaf and still others deep in the trunks of hardwood trees. Certain scale insects may spend their entire life span on a surface the size of a pinhead while the moth developing from the cotton leafworm may travel from Oklahoma to Canada.

Obviously such wide differences in habits necessitate different methods of attack. In the case of insecticides, different materials, formulations, strengths, dosages, and times and methods of application are required.

Not only are there vast differences in the habits of insects, but marked variation is shown in their

* Presented at AIF Meeting, Spring Lake, N. J., Sept. 5, 1946.

susceptibility to a given insecticide. Such variations may be manifest in the same species at various times of year, under different weather conditions, or in different parts of the country.

Much as we would like to be able to put into the hand of the farmer or home owner a "shotgun remedy"—one effective against all insects under all conditions—this appears to be entirely out of the realm of possibility. In fact, in my judgment, effective insect control in a balanced program, that will stand the test of time, is coming more and more to be a specialized field, demanding special materials applied with well-adapted equipment and under the guidance of men with special knowledge. We must recognize and bring insecticide users to realize that not only must we have the proper insecticide, properly prepared, but we must have it properly applied, at the right time, if we are to get satisfactory results.

Needs in the Field

METHODS of furthering the discovery and development of more effective, cheaper, and safer insecticides have been given much thought in the Bureau of Entomology and Plant Quarantine. Some of the needs in this field as I see them are:

(1) Standardized test procedures for preliminary screening and evaluation of stomach poisons and contact poisons especially from the standpoint of residual effect.

(2) The development of means of testing, on an extensive scale, insecticides found effective against insect pests under laboratory and plot conditions. Such tests should be made in various parts of the country under practical conditions yet with as accurate control as possible.

(3) Increased facilities for toxicological studies for the prompt and more complete determination of hazards to plants and animals presented by the use of materials found to have distinct insecticidal value.

(4) Closer cooperation of official agencies and industry in searching for and developing new insecticides and fungicides. This demands a basis of procedure that will safeguard the interests of the manufacturer and the public.

To further the development of more effective insecticides, especially for use in combating insects of military importance, the Bureau has worked rather closely with industry and the results have been so satisfactory as to indicate the desirability of continuing this practice. That this is being done is evident from the experimental data and discussion presented in this paper.

During the war the results of much research could not be made public at once, but in peacetime the value of early publication of experimental results seems evident. The main objections to this practice seem to be: (1) That the public is likely to consider the publication of experiments showing good results as recommendation of the material involved, (2) That the public may misinterpret results or draw false conclusions from them, and (3) That subsequent experiments under other conditions may give contrary findings. Clear statements as to the preliminary nature of the experiments, careful wording of conclusions, and publication in technical media would tend to meet these objections and obviate difficulties.

The press, being aware of the wide public interest in insecticides, is desirous of bringing to public attention all new developments. In headlines and brief popular statements it is hard to include all the limitations and qualifications. However, we feel that the press should take care not to overstate cases for or against new insect killers or repellents, for by so doing the confidence of the people may be shaken or more direct harm may be done.

So, in presenting some results of recent work done by the Bureau of Entomology and Plant Quarantine I wish to emphasize at the outset that the results must be regarded as preliminary; that they are not made as recommendations but are presented with the thought that they may serve as an indicator of possible fields of usefulness and of quantities and formulations of the newer insecticides mentioned that may be required in experimental work next season.

It should be emphasized that while some effort has been made to conduct experiments with the more promising new insecticidal materials known to us, no doubt some that have possibilities have not been included in our tests or are not covered in this statement. Also, it is well recognized that the field of coverage as to crops and pests is far from complete or adequate to evaluate the materials investigated, and that results of many tests in 1946 are not yet available.

Benzene Hexachloride

RESEARCH on benzene hexachloride (1,2,3,4,5,6-hexachlorocyclohexane) has been in progress much longer in Great Britain than in this country but much progress has been made in its entomological evaluation in the United States during the past 16 months. Lack of available methods and apparatus for determining the percentages of the several isomers which make up the commercial product and difficulty in isolating them in pure form have slowed the research with this material. Tests against a variety of pests have demonstrated the striking insecticidal properties of this material. Fortunately it kills some pests which are resistant to DDT and other insecticides. For practical purposes the gamma isomer is the only insecticidally active constituent of benzene hexachloride.

The persistent musty odor of benzene hexachloride is a distinct disadvantage. Although some of the material now being made is much less objectionable from this point-of-view, further reduction of odor will have to be made before it can be used for some purposes. Benzene hexachloride is also somewhat disagreeable to work with especially in dust form and appears to be highly toxic to honeybees. It exhibits some fumigating effect, but since it is more volatile than DDT it is less persistent. With regard to residues on harvested crops this is, of course, an advantage.

It appears that much remains to be done in standardizing commer-

cial benzene hexachloride. Since there is considerable variation in the products tested, the lack of uniformity of results is to be expected.

Comparative tests of benzene hexachloride, DDT, and pyrethrum on adult houseflies (Gersdorf and McGovran 1945) indicate that the gamma isomer of benzene hexachloride is about 18 times as toxic and DDT about twice as toxic as standard pyrethrins when applied by the turntable method. Comparison of materials, with such markedly different insecticidal action, by this method is recognized as of limited value.

Against housefly larvae gamma-benzene hexachloride killed 50 per cent of the larvae when added to the breeding media at the rate of 8 parts per million as compared with 77 p.p.m. for DDT and 928 p.p.m. for borax (McGovran and Piquett 1946).

As a residual spray for control of houseflies and mosquitoes benzene hexachloride is less persistent than DDT. It produces a more rapid knockdown of the yellow-fever mosquito than does DDT, but this is not true with the housefly. Against larvae of the malaria mosquito benzene hexachloride is highly toxic but distinctly less so than DDT.

Benzene hexachloride kills body lice even in very low dilution. It acts quickly on these insects but is less persistent than DDT; it also exhibited some ovicidal action. Its effectiveness against cattle lice and cattle grubs is also striking. Preliminary field tests indicate that this material is of value in controlling the blacklegged tick, the lone star tick, and the chigger.

Complicated formulas require specialized equipment for application and well-trained men to a thoroughly safe and efficient job

Important in Agriculture

IN THE agricultural field benzene hexachloride has shown special promise for use against cotton insects. Excellent control of thrips on plots of young cotton in the Rio Grande Valley of Texas resulted from dusting with 1.25 and 5 per cent of the gamma isomer of this insecticide in sulfur.

Cage and plot tests under way at several points in the South indicate that from 1 to 5 per cent of gamma-benzene hexachloride applied to cotton as a dust at rates of 6 to 8 pounds per acre is giving control of the boll weevil about equal to that of the standard calcium arsenate treatment. Apparently its protective action against the weevil does not persist so long as that of calcium arsenate. Plot tests at Florence, S. C., indicate that gamma-benzene hexachloride is as effective against the boll weevil at 1 per cent strength as at 10 per cent.

From 1 to 5 per cent of gamma-benzene hexachloride was found to be highly effective in controlling the cotton aphid. Mixtures of calcium arsenate and benzene hexachloride appear to be incompatible; at any rate, the addition of as much as 2.5 per cent of gamma-benzene hexachloride to calcium arsenate did not increase its effectiveness against the boll weevil and the mixture was much less effective against aphids than a similar percentage of benzene hexachloride in a neutral carrier.

Preliminary tests with benzene hexachloride against the tarnished plant bug, the cotton flea hopper, lygus bugs, stink bugs, and the red spider on cotton are showing encouraging results. In one small field test in Arizona last year a 1 per cent gamma dust applied four times during the season for the control of plant bugs and stink bugs gave a computed gain of 750 pounds of seed cotton per acre.

Benzene hexachloride has given outstanding results in tests against the white-fringed beetle. Commercial benzene hexachloride applied at a rate to give five pounds per acre of gamma isomer mixed in the top 3 inches of soil destroyed larvae in all stages of development. This material also showed promising results against stored-grain insects.

It was effective against tobacco thrips on peanuts and the vetch bruchid on hairy vetch, but did not persist so well as DDT. Encouraging results were secured against the sugarcane borer, the corn flea beetle, the corn earworm on corn, and lygus bugs on alfalfa. Against grasshoppers this material applied as a dust, a spray, or in baits showed erratic results, some of which were very satisfactory.

Benzene hexachloride has shown some toxicity to the Mexican bean beetle. Results obtained against the pea aphid have not equaled those with DDT. It was effective against the green peach aphid on potatoes in some tests in the Yakima Valley, Wash., but a condition similar to leafmold followed its use.

Against the codling moth benzene hexachloride was not highly effective when used as a spray at rates of 0.2 to 0.5 pound of the gamma isomer per 100 gallons. In small-scale tests the adult plum curculio, which is relatively resistant to DDT succumbed when fed on plants sprayed with 1 pound of a material containing 20 per cent gamma isomer to 100 gallons of water. Benzene hexachloride is showing promise for use against sucking bugs that cause deformities of peaches, and against certain pecan insects including the pecan nut casebearer, the black pecan aphid, and the pecan shoot curculio. It was less effective against the pear psylla than nicotine and against pear thrips than DDT.

In tests under way with benzene hexachloride as a soil treatment for the control of Japanese beetle grubs it appears that this material may be effective in dosages as small as ¼ or ½ pound of the gamma isomer per acre.

Some injury occurred to oats.

rice, and cowpeas grown on soil in which the top 3 inches had been treated with 5 pounds or more of the gamma isomer per acre. Since many plants, especially when young, show leaf burn when treated with benzene hexachloride at concentrations of 0.1 per cent or more, care should be exercised in its use. Further study is necessary to determine the toxicity of benzene hexachloride to higher animals, the extent to which its residues constitute a hazard, and a means of eliminating the musty odor and flavor imparted to food products.

As a residual spray against the elm bark beetle that carries Dutch elm disease, benzene hexachloride prevented feeding for 38 days as compared with more than 66 days for DDT of similar strength.

Tests in progress show that gamma-benzene hexachloride (0.4 and 0.8 per cent) in kerosene (w/v) or fuel oil is highly effective in protecting logs and lumber from ambrosia beetle attack. For periods of 3 to 6 weeks, at least, it was more effective than DDT and far more so than the usually recommended dichlorodiphenyloxide.

Hexaethyl Tetraphosphate

HEXAETHYL tetraphosphate was first used as an insecticide in Germany during the war and a formulation of it was called Bladan. This material has received special attention in the United States this year because of its reported efficacy against aphids and the scarcity of nicotine.

Preliminary tests in the laboratory and field indicate that it holds considerable promise. It is readily hydrolyzed, and in some formulations loses its killing power in a few hours. It is highly toxic to higher animals and somewhat disagreeable to apply; however, this is also true of nicotine insecticides. Apparently its rapid decomposition removes any serious residue problem. Plant burning may result from using it in concentrated form.

In laboratory tests carried out by the Bureau in Wisconsin against cabbage aphids and pea aphids hexaethyl tetraphosphate as a 3 per cent dust was more effective than nicotine sulfate dust at the same strength. Outdoor single-plant tests in California have corroborated these findings with the cabbage aphid. We understand that it has shown good results in field tests against other aphids in California. Metcalf has found in the laboratory that the median lethal concentration of this material against thrips is 0.01 per cent, against *Drosophila* 0.00075 per cent, and against the citrus red spider 0.0075 per cent. The last result seems to indicate that it has possibilities against mites for which a good remedy is badly needed.

In small-scale field tests conducted at Spokane, Wash., this material was effective against the pear psyllid, the results comparing favorably with those obtained with nicotine alkaloid. Laboratory tests at Beltsville, Md., showed that all codling moth larvae were killed with a spray containing 1 pound of relatively pure hexaethyl tetraphosphate per 100 gallons.

Azobenzene

ALTHOUGH azobenzene can hardly be considered a new insecticide, interest in it has recently increased. In laboratory tests at Beltsville against the two-spotted mite, this material in the form of a wettable powder has given outstanding results. In field tests at Vincennes, Ind., formulations containing 1/3 pound of azobenzene and 3/4 pound of DDT applied as a spray were only about 50 per cent effective in suppressing orchard mite infestations. When used as a fumigant in greenhouses at Beltsville and elsewhere it has been found effective in killing the eggs of the common red spider. At the rate of eight grams of the crystals per 1000 cubic feet with a six hour exposure, 87 to 95 per cent of the eggs were killed.

"3956" as Insecticide

EXPERIMENTAL work involving a considerable range of insects shows that "3956" has marked insecticidal power. Its action is similar to DDT in that it has a slow knock-down and kill and a spray residue that is persistent. As a contact spray or in aerosols, and also as a spray residue, it appears to be less toxic to houseflies than DDT. Against yellow-fever mosquito adults it is slower acting as a residual spray and slightly less toxic as a contact spray than is DDT. Its persistence in residual deposits has not been fully determined.

Against body lice results with "3956" have been outstanding; it is more toxic and more persistent than DDT. Many household pests, including cockroaches, bedbugs, and carpet beetles, are susceptible to this material, although further work in this field is required to fully evaluate it.

"3956" has been tested against a considerable number of agricultural pests but its toxicity to plants, animals, and soils does not appear to have been explored extensively. In laboratory tests it showed considerable toxicity to the southern armyworm, certain cutworms, and the celery leaf tier. In cage tests it killed some boll weevils, bollworms, tarnished plant bugs, and cotton aphids, but appeared to be less effective than a number of other materials.

A field trial against adult *Melanoplus differentialis* grasshoppers in alfalfa indicated that a dosage of at least 4 pounds of "3956" per acre, either in dust or spray form, was necessary to obtain a high kill, and that it continued to be effective for 10 or 11 days after application.

"3956" was found very effective in killing young European corn borer larvae in the laboratory and initial tests on the sugarcane borer were promising. Results against corn earworm and grasshoppers were erratic. In one test an application of 1 pound to 100 gallons of water slowly reduced the orchard mite population by 98 per cent.

"1068" Insecticide

A CHLORINATED hydrocarbon designated as 1068 has attracted much attention since the publication of initial results by Kearns, Ingle, and Metcalf (1945). These authors compared "1068" with DDT against a number of insects and regarded it as more toxic than DDT to a number of species, including the spirea aphid, the pea aphid, the Colorado potato beetle, the squash bug, the housefly, and the American cockroach. Some of these findings have been corroborated

(*Turn to Page* 39)

Stock Sprays of Tomorrow*

By Ray L. Cuff
National Live Stock Loss Prevention Board
Kansas City, Missouri

SINCE the introduction of DDT to the livestock industry in 1945, farmers and ranchers are no longer satisfied in using a kerosene spray which would give cattle freedom from flies during probably only one milking period. Livestock growers now want an insecticide that will kill *all* flies that light on animals, and will continue to kill insects for a period of two weeks. Although DDT does a marvelous job in killing horn flies, house flies and mosquitoes on cattle, yet in concentrations commonly used it is not effective in controlling stable flies, horse flies, bot flies, screwworm flies and heel flies on the animal. DDT effectively controls only those species of flies that remain on the host animal long enough to absorb a lethal dose.

A simple specification for a good livestock spray is one that will continue to kill stable flies on the legs of cattle and horses over a period of two weeks. These sprays must be safe, non-irritating, reasonably priced and yet should be sufficiently potent to kill lice and ticks.

With a probable meat shortage staring the whole world in the face for the next year or two, the livestock producer is confronted with the problem of producing more meat, milk, wool and sound leather despite the handicap of less feed, less manpower and more parasites. DDT fly control tests have shown that controlling flies is one of the quickest, cheapest and most dependable and efficient methods of increasing beef and milk production with no extra cattle, no extra feed and with very little extra labor.

Good Results in Kansas

THE Kansas co-operative hornfly control tests conducted during the summer of 1945 on some 8,000 cattle on 32 farms and ranches in 16 counties, under the joint supervision of the United States Bureau of Entomology and Plant Quarantine, the Extension Division of Kansas State College of Agriculture, Office of the Livestock Sanitary Commissioner of Kansas and the Kansas City Office of the National Live Stock Loss Prevention Board, showed that by actual weights of cattle in-and-out of pasture the sprayed cattle made an average additional gain per head of one-half pound per day more than like untreated cattle, during the 90 to 100 days when flies were most numerous.

Treated animals which were kept on pasture throughout the entire summer season made an average additional gain of about 50 pounds per head. One group of 27 calves in the treated lot made an average gain of 73 pounds over the 28 calves in the untreated lot. This gain was largely attributed to the fact that cows in the treated lot produced more milk for their calves, because these cows were not pestered with flies.

Informed cattlemen state that, this season, at least one-half of the 2,830,000 beef cattle in Kansas and one-half of the 2,070,000 beef cattle in Oklahoma will be treated with DDT. Fifty pounds additional gain per head on half of these 4,900,000 cattle in Kansas and Oklahoma can mean an extra 122,500,000 pounds in

Cattle sprayed with DDT gain one half pound per day more than herds continually bothered by flies, lice and other types of parasites

*Presented at meeting of Agricultural Insecticide and Fungicide Association, September 4, 1946, Spring Lake, New Jersey.

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Flies literally eat up profits in the livestock business. As seen on the back of this bull, they congregate where the animal can reach them with neither tail nor nose. Animals reduce weight fighting pests, fail to graze steadily, and lose nourishment through blood-sucking parasites. DDT provides a logical solution.

☆

weight, which is equivalent to 73,500,000 additional pounds of Beef. What other practice will pay as big dividends and serve hungry humanity as effectively as this DDT fly control program?

1945-46 Fly Control Tests

IN OUR 1945 cooperative tests we used 0.20% DDT suspensions or emulsions for spraying and 0.10% DDT suspension or emulsion for dipping. In 1946 we are using as a spray 50% DDT wettable powder in water suspension in DDT concentrations of 0.25%, 0.50%, 0.75%, 1.00%, 1.50%, 2.00%, 2.50%, and 5.00%. In the single dipping test 0.20% DDT in emulsion is used. Last year, the tests were conducted on 32 farms in 16 counties, well scattered over the state of Kansas. This year, the tests are divided on beef herds half in Kansas and half in Missouri. The State of Missouri is furnishing us three large dairy herds to determine the value of DDT on farm milk production.

It appears from what we have seen this season that increasing the percentage of DDT from 0.20% to 0.25% is increasing the duration of effectiveness of the first spraying from an average of 13.9 days to three weeks or longer. This increase in length of protection is very significant to the livestock grower as he may have to round up his cattle only two or three times instead of four times each summer. The cost of spraying cattle is a small item compared with the cost of rounding up range cattle in very large pastures.

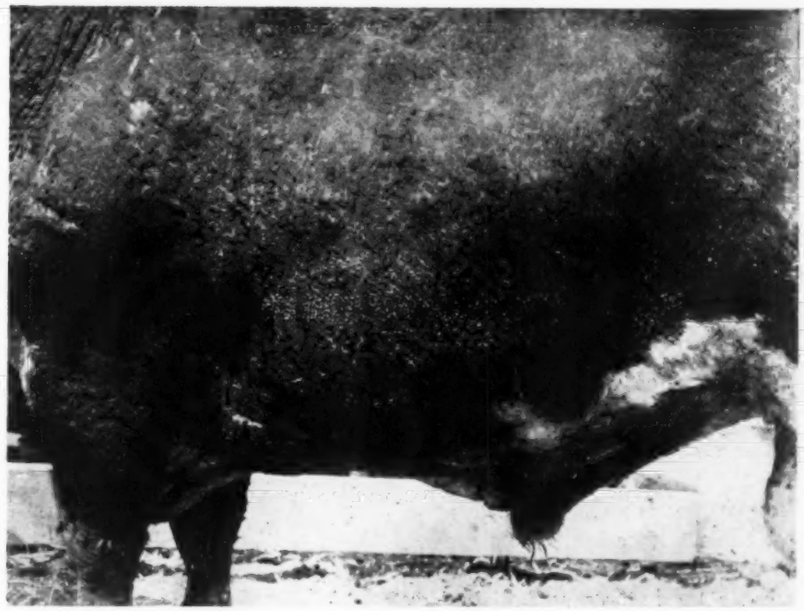
Although it is too early to evaluate the results of our 1946 tests, it appears evident that in the Southwest it will be profitable to use a higher DDT concentration than was used in the 1945 Kansas tests. Research conducted by the United States Bureau of Entomology indicates that 1.00% of DDT properly applied as a spray or dip kills all species of lice on cattle and usually has long enough residual effect to kill young lice as they emerge from louse eggs. Weaker concentrations may kill the motile forms of lice, but will not have the residual effect to kill young lice as they hatch.

In the Southwest we are recommending a minimum of 4 pounds of 50% DDT wettable powder to 100 gallons of water, 0.24%, for use in power sprayers and double the amount of DDT for use in hand sprayers which deliver less volume of liquid per minute. To apply the proper amount of DDT with a small hand-sprayer on an animal the average farmer will get better fly control by increasing the concentration of his spray.

In our cooperative tests, this season, we have been spraying only one quart of DDT suspension per mature animal in concentrations of 0.50% to 5.00%. In the weaker dilutions of 0.25% DDT we are applying two quarts to the back of each treated mature animal. One quart of the more concentrated material sprayed at around 500# gauge pressure with a two-nozzle broom is giving remarkably good fly control. The average operator who shoots a gallon or more of spray material at an animal from any angle or from too great a distance does not realize that it is only the material that sticks on the animal that counts. The run-off is practically valueless.

We find that a very practical method of spraying large herds of cattle is to fill an eight-foot alley rather tightly with cattle. From a catwalk on either side of the alley we can do a more exact job of spraying by holding the nozzles close and perpendicular to the surface of cattle. These spray alleys that can now be found in increasing numbers at the corner of four pastures help in doing a faster, better, more economical spraying job. Most of the dairy cattle are sprayed in stanchions.

In our own tests, last year we started spraying the underline of cattle as well as the backs of cattle with the thought that the residual material would be protected from the direct rays of the sun and highest temperatures. We found that spraying the underline as well as the topline gave



DDT is death to cattle lice which are usually difficult to kill. This bull has received application of DDT which causes lice to come to surface and drop to ground where they die. Improved spray methods cover under portion of animals as well as sides and back, and strong concentrations of insecticide assure control of livestock pests.

approximately an additional week's protection from hornflies. This year we are doing some tests in spraying just the underline. We first used our regular spray guns for underline spraying. Later, we helped work out the mechanical underline sprayer. Ranchers and farmers who have tried underline spraying usually continue the practice. A practical operator stated: "We get the lice and one additional week of fly protection by good underline spraying."

DDT at Stockyards

IN JUNE 1946, the first service of spraying outbound feeder cattle with DDT was offered at the Kansas City Stock Yards at a cost of 15c per head with a maximum of $6.00 per carload. The spray chamber at Kansas City is 30 feet long and 10 feet wide. —large enough to hold a carload of cattle. Animals are thoroughly wet by spray from 300 topline nozzles and 150 underline nozzles.

As feeder cattle go into many localities in different states where the DDT treatment of feeder cattle has not been started, our treated cattle are giving many cattlemen their first practical introduction to DDT fly control. One buyer of feeder cattle wrote: "What did you spray on the steers we bought at your market? For a month now they have not been bothered with flies, while my own cattle across the road are being eaten up with flies."

Where sprayed cattle regularly come in contact with barns and sheds, good operators have found it necessary to spray the barns and sheds to control the aggravating horse-fly. One of the best methods of ridding barns and sheds of stable flies, fleas, etc. is to spray these buildings at the start of the fly season with a 5.00% DDT water suspension spray. Then, each time the cattle are sprayed "touch up" the surfaces with the extra material left in the tank from spraying the cattle. Such spraying clears the insulating dust off the old, residual spray and reactivates it. Some of our cooperators are getting good results by spraying barns and sheds with the regular cattle concentration each and every time the herd is sprayed.

In a few places in Kansas, cattlemen started spraying a few trees with DDT to get rid of stable flies. To their surprise they also killed many Tabanids.—the big horsefly. At present, a number are spraying trees in pastures and lots. Further tests will be needed to determine the practical value of this practice.

Area DDT Spraying

THIS year, Ellsworth County, Kansas, has an area of 90 square miles in which all of the cattle and many of the farm buildings have been sprayed with a 0.20% DDT water suspension mixture. County Agent Coleman states that people living in this area are now strong for fly control, for all houses, barns, sheds and livestock are practically free from flies. He states that about 85% of the cattle in Ellsworth County have been sprayed and kept sprayed with DDT. One man living in this area said: "Now we don't have to stop to brush the flies off the screen doors before we go into the kitchen. In fact, this is the first summer I can remember when we did not actually need screen doors to keep out flies and mosquitoes."

We are seeing some outstanding examples of the benefits of fly control on an area basis in our cooperation DDT fly control tests. One test lot of 156 steers on feed in pasture we sprayed with two quarts of a 0.25% DDT mixture June 1. These cattle were observed for fly counts every third day for the first 21 days by the county agent and owner and at weekly periods thereafter. When these cattle were sold August 20, eighty days after spraying, the fly count was less than 10. We examined these cattle two weeks before they were sold and found an average count of 5 hornflies per animal. All cattle surrounding this lot of 156 steers were sprayed throughout the summer.

In the case of a breeding herd of pure Shorthorn cattle in our cooperative tests, this year, this herd was sprayed with a 1.50% DDT suspension spray. Now about three

months later these cattle have but a negligible hornfly count,—an average of 6 to 7 per head. This farm is in the center of a sprayed area. The near neighbors' cattle are also free from flies, but farmers from six or more miles from this farm marvel at seeing a good-sized herd that has remained nearly free from flies throughout the summer season. The barns and sheds on this farm were sprayed, some once and some twice. Proper area spraying of cattle combined with a rather dry 1946 summer helped keep down this fly count.

Failure to remove manure piles may cause condemnation of the most efficient insecticides. Any man who does a thorough job of spraying his cattle and barns expects his animals to be free from horn, stable and house flies as well as mosquitoes. But those who neglect to remove manure piles and other fly-breeding places near barns may be disappointed. Such individual is too likely to blame the insecticide used instead of putting the blame where it belongs—on his own faulty barn yard management.

Flies spread Anthrax and Anaplasnisis. Operators who make a practice of spraying cattle, calves and barns thoroughly state that fly control is a factor in preventing the spread of calf scours. Raw spots made by hornflies on animals, underline and punctures of the skin made by Tabanids of other blood-sucking insects provide an ideal spot for the screw worm to lay its eggs.

Several manufacturers of insecticides are co-operating with our office and furnishing some of the newer materials to be tested under practical farm conditions. Our method of procedure is to purchase a few suitable animals and keep them in pens to determine whether or not the materials are toxic, will take their hair off, burn, irritate or harm animals in any way and control the insects desired. Then we run tests on farm and ranch herds under practical field conditions.

Benzinehexachloride

ONE of the newer chemicals we have tested this year is benzine hexachloride. It shows much promise as an insecticide, ovicide, and larvicide during cool weather. Our experience is that the residual effect in hot summer is much shorter than in fall and winter months. In 100 degree temperature benzine hexachloride tests in a 0.50% spray on backs of cattle controlled horn flies for only four to five days. When both underline and backs of cattle on the same farm were sprayed horn flies were controlled for ten days. Benzine hexachloride is one of the few chemicals that will kill both cattle lice and eggs at one treatment.

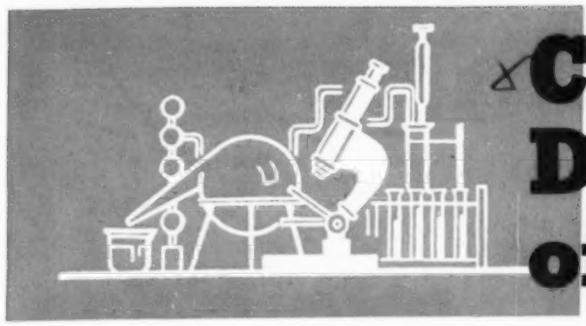
When the legs of horses and mules were treated twice a week, stable flies and bot flies appeared to avoid treated animals. We found it to have a faster knock-down than DDT in similar concentrations. We have used the Methoxy of DDT alone and in combination with DDT and benzine hexachloride. Tests with the Methoxy have given uniformly good results. It has shown faster knock-down with as long residual effects as DDT. The Methoxy of DDT we tested is worthy of more extensive tests.

The new "fixed Pyrethrum" we have tried gives much longer residual effect than the old standard material which seemed to lose its effectiveness in comparatively short periods.

"Perfect Spray" Foreseen

AGAIN may I suggest that the average farmer and rancher is looking forward to the time when he can purchase the fly spray of Tomorrow which when properly applied will keep on killing the stable fly on legs of farm animals for a period of at least two weeks.★★

The author, Ray L. Cuff, spraying cattle with DDT for control of flies. Picture taken at Matfield Green, Kansas. (Photo courtesy of Bean Mfg. Co., Lansing, Michigan.)



Colorimetric Determination of DDT in Milk[1]

By Milton S. Schechter, H. L. Haller and Milton A. Pogorelskin

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PHARMACOLOGICAL investigations (*20*) have shown that ingested DDT accumulates as such in the fatty tissues of animals. Some of the ingested DDT is excreted unchanged in the feces, and some is converted to bis (*p*-chlorophenyl) acetic acid (*3, 17*), which is excreted in urine (*6, 7, 19*). Unchanged DDT has never been conclusively demonstrated in urine. Woodard *et al.* (*20*) were the first to demonstrate the presence of DDT in milk and fat (of dogs). These investigators and Ofner and Calvery (*7*) used the Schechter-Haller colorimetric test (*9, 11*) without mentioning any difficulties in the nitration step. Telford (*15*) and Telford and Guthrie (*16*) carried out DDT-feeding experiments on goats and rats, using rather high dosages, and found that the secreted milk could kill other animals to which it was fed. Telford (*15*) also conducted biological tests against houseflies. These investigators recommended that the whole problem be investigated further.

The presence of DDT in fat-containing foods assumes importance for two main reasons. In the first place, when dissolved in oil or fat DDT is absorbed more readily from the alimentary canal (*12*) than when present as a dry, undissolved residue. Secondly, DDT is a cumulative poison (*12, 20*), and its concentration in the body (particularly in the fat) can build up to fairly high levels even though the daily intake is low. This may be especially important in the case of infants, whose chief food is milk.

Since such staple foods as milk, butter, meat, fat, and eggs are used universally in enormous quantities, the Bureau of Entomology and Plant Quarantine started an investigation of some of the factors involved in their contamination with DDT following the use of feed crops treated with this insecticide. An essential part of this program was the development of a method of analysis which would conclusively demonstrate the presence of DDT as such and estimate its amount in these foodstuffs. Many of the methods of analysis (*1, 13*), particularly those depending upon the determination of chloride (*4, 5, 12, 18*), are neither specific nor sensitive enough to detect traces of DDT, especially in the presence of the large amounts of fatty matter which accompany the DDT in organic-solvent extracts of these foodstuffs.

The Schechter-Haller method is unsatisfactory for more than a few tenths of a gram of fat. Attempts to analyze larger amounts led to violent nitrations and low or negative results. It therefore seemed essential to find a procedure which would remove most of the fat and concentrate the DDT. Chromatography was not successful, and low-temperature (solid CO_2) precipitation of the fat gave rise to difficulties in filtration. Saponification and use of the unsaponifiable portion of fat might be satisfactory were it not for the fact that DDT is thereby dehydrochlorinated. Stiff and Castillo (*14*) attempted to utilize this procedure in conjunction with their pyridine-xanthydrol-KOH reaction (*13*) (which does not distinguish between DDT and dehydrochlorinated DDT), but they were unable to demonstrate the presence of DDT or dehydrochlorinated DDT in various organs or body fluids of rabbits after oral administration of DDT, except in the feces. They concluded that DDT is not present as such in organs and body fluids after oral administration. This is contrary to the experience of Woodard *et al.* (*20*), who demonstrated the presence of DDT as such in the milk and fat of dogs, and to our experience with the milk, meat, and body fat of cows.

The observation that fats are readily soluble in concentrated sulfuric acid, and that DDT is practically insoluble in this acid, led to the development of a procedure (*10*) for the determination of DDT whereby all but a small residue is eliminated from fatty materials. This residue probably is composed mostly of hydrocarbons. Briefly, the method consists in extracting a chloroform solution of the fat sample twice with a sodium sulfate-

(*Turn to Page* 46)

[1] This research was conducted as part of a program supported by transfer of funds from the Office of Quartermaster General, U. S. Army (Office of the Surgeon General of Corps of Engineers), to the Bureau of Entomology and Plant Quarantine.

Toxicology of Insecticides and Fungicides

IT BEHOOVES manufacturers of insecticides and chemical compounds in general to make every possible effort to understand the potentialities for harm engendered by the production and application of such substances. It is not enough to know that this or that compound is an efficient insecticide, but we should know what ill effects, if any, exposure to these compounds may bring about in man.

The ideal insecticide has much in common with the ideal therapeutic agent or drug administered to humans against infections or parasitic diseases. In both cases research is always directed towards producing an agent which will kill or prevent the further growth of the attacking organism or parasite without harming the host. In both fields, to accomplish this end, a knowledge of the toxicology of the compounds employed is prerequisite to their intelligent use. Unfortunately, most compounds which are efficient insecticides and fungicides are likewise rather highly toxic for man. Since application of these compounds is made by man, we, as medical men, are very much concerned with their potentialities for harm to humans.

Toxicology may, for practical purposes, be defined as a study of the mode of action by which poisonous effects are produced. Toxicity, therefore, may, for practical purposes, be defined as an expression of the potentialities of a given substance for destroying life or seriously interfering with vital functions when absorbed into the system. Likewise, the terms poisonous and toxic are interchangeable. Just what constitutes a poison has been the subject of many a lengthy and futile debate. Recently a committee for the Manufacturing Chemists' Association has adopted as the definition of a poison the following:

> "A poison is a substance which, when taken by mouth in quantities of 60 grains, (4 grams) or less, or when inhaled in concentrations of less than 200 parts per million by volume in the air, rapidly jeopardizes life by other than mechanical or physical action."

This is a rough and ready definition, which leaves much to be desired, as far as a high degree of accuracy goes. However, it does serve the purpose of setting up a standard by which poisonous substances can be labelled with some degree of consistency.

How Poisons Act

THERE are three routes of absorption of poisonous substances into the human system. In the manufacture and application of these compounds, the routes of greatest importance, are, first, by inhalation (i.e., through the respiratory tract), and, second, through the intact skin. The third route of absorption, that is by mouth or through the gastro-intestinal tract, is of much less importance in industrial exposures. Inhalation of a compound, whether it be in the form of dust, spray, fog, mist, vapor or gas, upon reaching the lung proper, results in very rapid absorption. Tissues of the lung present very large surfaces of thin membrane, easily penetrated and richly supplied with blood vessels. When we consider that from eight to twelve cubic meters of air are inhaled in an eight hour day in the average occupation, the importance of this route of absorption becomes clear. Also, in respiratory tract absorption, as well as in absorption through penetration of the skin, the toxic compound directly enters the general circulation and is immediately distributed to all of the vital organs of the body. In contrast with this, absorption through the gastro-intestinal tract is slower, since the offending substance must pass through the stomach and intestines and a significant part enters the portal circulation and passes to the liver. The liver, of course, is the great detoxifying center of the body. In this way, toxic compounds, when taken by mouth, are, to a greater or lesser degree, depending on their nature and concentration, modified and detoxified before reaching the general circulation.

Of course, many compounds are not appreciably absorbed through the intact skin. In general, the fat soluble or fat solvent compounds, as a group, do enter the skin very readily. Water soluble compounds, which usually are not fat soluble, as a rule do not penetrate the skin appreciably.

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Skin penetration may be of great importance to those actually applying insecticides, not only because of the inherent toxicity of the compound utilized, but because of the vehicle in which it is dissolved or suspended. For example, some of the best solvents for DDT cannot be employed because they themselves are much more toxic than DDT. Kerosene, for example, which is a relatively inocuous compound, will dissolve DDT to a concentration of about 10%. Isophorone, on the other hand, if used as a solvent of DDT, will hold 50% in solution. This solvent, however, is too toxic to permit of day-in and day-out use because of its cumulative and rather insidious effects.

Manufacturers of insecticidal and fungicidal compounds who are also students of their efficacy and mode of action, may not always be aware of the potentialities for harm to the human of such substances. It is, of course, not within the scope of this discourse to attempt to go into the multiplicity of alterations in physiological processes which are brought about by absorption into the human system. The nature of these changes differs so widely that it is difficult to deal with them adequately in comprehensive texts devoted to pharmacology and toxicology.

*Presented at meeting of Agricultural Insecticide and Fungicide Association, September 4, 1946, Spring Lake, New Jersey.

Further Dangers

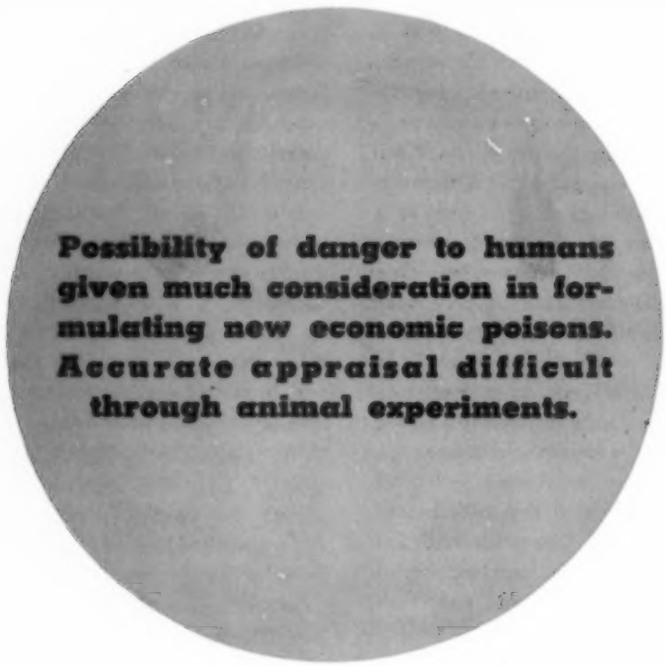
A FEW modes of action may be of interest, however. All animal life is dependent upon an adequate supply of oxygen to the minute cells which constitute the organism. When cells are deprived of oxygen, they die. The destruction of relatively few cells in a vital organ may result in severe illness or death. For example, hydrocyanic acid exerts its effects by interfering with the cycle of oxidation and reduction in tissue cells which is essential to life. Thus, even though arterial blood brings to these cells an adequate supply of oxygen, it cannot be utilized by the tissues, and death inevitably results if this cycle of oxidation and reduction is seriously impaired long enough. However, hydrocyanic acid in sub-lethal concentrations is rapidly detoxified by combining with sulfur present in the body and is then excreted as a non-toxic thiocyanate. Poisoning from hydrocyanic acid, because of this rapid and complete detoxification in sub-lethal concentrations, has an "all or none" effect. In other words, either death results or recovery is complete.

Certain of the organic fluorides and phosphates, which are of considerable theoretical interest as insecticides, are profoundly toxic to humans by an entirely different mechanism. This group of compounds apparently exerts its effects by the inhibition or destruction of an "enzyme" chlorine esterase, the presence of which is essential for the transmission of nerve impulses from the central nervous system to the end organs or the parts of the body to which the impulse is directed. Since a constant flow of impulses through both voluntary and involuntary nerve trunks is necessary to the maintenance of life, failure of such impulses to reach their destination causes death by general paralysis.

Methyl bromide exerts somewhat similar toxic effects by an entirely different mode of action. It apparently has an affinity for the tissue comprising the central nervous system, of which the brain is, of course, the center. Excessive exposure to this compound results in damage to the cortex of the brain and to the tissues covering the brain. The cortex of the brain is, of course, the outer layer which contains the cells in which impulses originate which control all of our voluntary and many of our involuntary actions and reflexes. Thus, damage to these cells may bring about serious illness or death, depending upon the concentration absorbed. It also, in very high concentrations, may be markedly irritating to the tissues of the lung, to such an extent that fluids are poured out into the lung, with resultant severe respiratory embarrassment and even death.

Carbon tetrachloride, which is widely used as a solvent, also directly affects the central nervous system when absorbed in excessive quantities. In addition, however, it may cause liver and kidney damage. These effects are frequently delayed in making their appearance and may become manifest several days after exposure has ceased. This compound, and certain of the other chlorinated hydracarbons are, therefore, insidious. These compounds have been cited merely to illustrate the wide variation in modes of action which may be responsible for causing damage to the well-being of warm-blooded animals. There are, of course, many other modes of action which cause damage and death and all sorts of permutations and combinations of effects may interfere with or destroy physiological processes essential to well-being.

To assay toxicity is a difficult problem. The only feasible approach to it is, of course, by animal experimentation. Unfortunately, we cannot, by looking to the structural formula of a given compound, predict, with any degree of accuracy whatever, what its pharmacological or toxicological effects may be. If we could predict such effects from structural formulae, our task would indeed be greatly simplified. However, through bitter and painful experience, we have learned that the substitution of a single radical or the change in position of a single radical in an organic compound may alter its pharmacological properties completely. Unfortunately, such substitutions and changes do not adhere consistently to any given pattern. There is no choice


Possibility of danger to humans given much consideration in formulating new economic poisons. Accurate appraisal difficult through animal experiments.

then in attempting to solve the problem of toxicology but to study, through animal experimentation, each new preparation which appears to be of commercial importance. It is obviously impossible to investigate thoroughly new compounds until their commercial value has been established.

Expensive Experimentation

ANIMAL experimentation is an expensive, laborious, slow process and one which interposes many pitfalls. Only comparatively recently has the difference in response of various species of animals to the same compound been recognized. In the good old days, it was thought to suffice if a few guinea-pigs were fed or given parenterally enough of this or that compound to establish the M.L.D. or minimum lethal dose. We now know that the guinea-pig may metabolize or catabolize a given compound entirely differently from the white rat, cat, dog or the monkey. Likewise, the dog and the monkey may show great disparity in manifesting toxic effects from dosage equivalents. This realization has greatly complicated toxicological studies with animals and has made us much more cautious in trying to interpret results obtained. Obviously, it is not enough to determine the M.L.D. or the LD 50 (the dosage which kills one-half the animals). We must, in addition, try to find out what effects repeated sub-lethal doses bring about. In all such experimentation, it is obviously necessary to run comparable control groups of each species of healthy animals throughout the study and to see that such animals receive the same diets in every respect as do the test animals and that they are maintained in identical environments. Since industrially the important routes of absorption are through the respiratory tract and through the skin, we cannot be content with feeding experiments alone, but experiments must be made in which exposure represents working conditions as accurately as possible. Therefore, to get any idea about respiratory tract absorption, it is necessary to expose test animals in vapor or gas chambers or in dusting chambers, preferably under conditions in which standard temperatures and humidities are maintained. This exposure must be continued day after day for weeks and months in sublethal concentrations if one is to recognize cumulative effects. This must be carried out with several animal species to be really meaningful. To follow changes which may be caused by repeated exposure, it is necessary, during the life of the animal, to make repeated blood studies and examinations of their excreta. If animals die, they must be autopsied for evidences of gross pathology and then each vital organ must be sectioned and stained for microscopic evidence of histopathology. To omit histopathological studies would be to neglect the opportunity for observing the early changes which produce the toxic effects before they become grossly manifest. Such information is, of course, essential to any thorough study. Any study less complete than this leaves so many gaps in the picture that the purpose of the study is defeated.

Chronic Studies

BY beginning with "acute" toxicity studies leading to the determination of the LD 50's, first with white mice and then with various other species thought desirable in a given study, the ground work is laid for "chronic" studies, and, as previously outlined, these chronic studies are made not only through feeding tests, but by inhalation of vapors or dust of the compound, as the case may be, and, in addition, by repeated application of the compound to the skin. Of course, skin absorption tests not only give us an idea as to whether or not the compound under investigation readily penetrates the intact skin of the animal, but as to whether or not it is a skin irritant. Unfortunately, there are no good test animals for irritant and sensitization effects, since no commonly used experimental animal has skin with pores and sebaceous glands, as does the human. So that, as far as skin irritant and skin sensitization phenomena go, we can get from experimental animals only the most preliminary sort of results. For a true estimate of dermatitis producing properties we must turn to the human for meaningful results after we have satisfied ourselves that, first, the compound is not too toxic to be applied to the human skin, and, secondly, that it is not too grossly irritating for such applications. Human patch tests, to be significant, when a compound is obviously not universally irritating, must be applied to at least two hundred individuals for a period of a week to

observe primary irritant action. Then, after a week's rest period, the patches should be again applied to the identical area previously used and again be allowed to remain in place for an additional week to find out whether or not the initial application had caused sensitization or an allergic reaction of the skin to have developed.

Such experimentation costs a great deal of money. It is usually preferable to use animals which are of a standard breed and whose hereditary history is known and which have been reared under satisfactory conditions of diet and hygiene. If pups of this type are bought and reared to maturity, each one will cost approximately $250 by the time it is ready for experimental use. On the other hand, if mongrels are bought from the dog pound they must be isolated for long periods to make sure that they are free of communicable disease; they must be wormed, immunized against distemper, and put on standard diets for varying periods. Such an animal probably costs $40 by the time it is ready for experimental use. Obviously, it is futile to start off by using sick animals or animals with dietary deficiencies, since their disease process hopelessly beclouds toxicity studies. Monkeys can be purchased for $15 to $30. They likewise, must be carefully observed for varying periods before they can be used for experimental purposes. Monkeys, like humans, are subject to malaria, tuberculosis and other ills to which man is heir. Recently, our laboratories bought five monkeys and three of them were found to be suffering from well advanced tuberculosis of the lungs. Even after experimental animals have been carefully observed and prepared for experimentation, the strictest precautions must be taken during their lifetime to make sure that an epidemic of disease does not bring a costly experiment to an abrupt and meaningless end.

Now let us assume that we have successfully concluded a year of study of the chronic toxicity of a compound. Further assume that we have started with fifty white mice, twenty white rats, twenty guinea-pigs, ten rabbits, five dogs, five monkeys and a like number of controls for each species. We have carried out feeding tests, exposures by inhalation, by skin absorption. Some of the animals have died during the course of the experiment, some have died from intercurrent infection, such as pneumonia, some animals remain alive to the end of the experiment and apparently are well. All of these must be sacrificed and examined for evidence of gross pathology and microscopic tissue changes. Finally, we assemble all of the accumulated data and try to draw valid conclusions as to the toxicology of the compound being investigated. We may find that the predominant toxic effect is upon the respiratory tract or the liver or the kidneys or upon the central nervous system or upon a combination of all four. There usually crop up some unexplained differences, not only in varying species, but in the same species, which must be taken into consideration. Our purpose, of course, from the outset, has been to attempt to evaluate the toxic potentialities of this compound for the human. Usually a pretty good guess can be made, but it is not feasible to translate such results directly into human equivalents. We will, however, have a pretty good idea about the precautions necessary to safeguard the welfare of men producing these compounds or customers who will likewise handle the finished product.

Basis for Proper Labels

WITH such information at hand, we can intelligently label products so that they may be safely handled. Many agencies now are maintaining laboratories for such investigations. Among these are the larger chemical and pharmaceutical manufacturers, the U.S. Public Health Service and numerous universities. However, because of the multiplicity of problems which are presenting themselves for such investigation and because of the laborious, time-consuming nature of such work, existing facilities are proving inadequate to meet the demand. Also, because of the lag between marketing a commercially important product and the time which elapses before such studies are completed, it is frequently necessary to make available to the user such products after only preliminary investigations as to toxicity have been completed.

The Manufacturing Chemists' Association has recently completed carefully worked out recommendations for standard labeling of all chemical compounds which are being marketed, either on a commercial basis or for experimental use. The Committee which has compiled these recommendations consists of representatives of all interested industries. They are to be congratulated for having produced, after no little effort, a uniform code, which, it is hoped, will be adhered to by all firms marketing chemical compounds, whether they be in the field of insecticides, fungicides or flotation agents for the mining industry. In addition, this same organization is now preparing detailed bulletins which set forth methods for the safe handling of toxic compounds and these include first aid measures and, in some instances, recommendations to the physician for treatment. This, as well as the intelligent interest and cooperation of governmental health and hygiene agencies and of manufacturers and consumers, large and small, portends a much needed interest in and more enlightened attitude towards the preservation of the health and well-being of the millions of individuals who will be exposed in some degree to chemical compounds of commercial importance. ★★

Toxicological tests form basis for proper labeling as to handling and application of given insecticides.

ELECTROSTATIC EFFECTS PRODUCED IN DUST CLOUDS[1]

By
H. F. Wilson and M. L. Jackson[2]

How electrostatic charges affect the dispersion of insecticide-bearing dusts and cause variations in effectiveness

DURING an investigation of rotenone dusts at this Station for control of the pea aphid it was found that there was a wide variation in the results obtained in field experiments with dusts containing similar concentrations of rotenone. One of the causes for these variations has been traced to differences in the characteristics of different mineral dispersants used. One difference seemed to be related to dust dispersion on plants and insects which in turn seemed to be influenced by electrostatic charge effects produced in applying rotenone-bearing dusts.

When pea plants infested with aphids were dusted in the greenhouse with dusts producing variable charges it was found that a wide difference in the dispersion of dust particles occurred which could be correlated with electrostatic charges. In testing the electrostatic effects, standard quantities (0.5 gms.) of dust were blown through an insulated copper tube connected to an electrostatic voltmeter. The total electrical capacity of the system employed was 17 MMF, so that each 1,000 volts registered on the voltmeter was equivalent to a net charge on the dust cloud of 1.7×10^{-8} coulombs or 50 e.s.u. of charge. On the basis of preliminary observations a hypothesis was established to the effect that the net electrostatic charge in the dust cloud has the combined effect of (A) preventing flocculation of particles and (B) promoting dispersion onto the stems and underleaf as well as on the upper leaf surfaces. In applying this hypothesis, three general conditions developed. (1) If the average size of the particles of the dispersant was approximately 2 microns or less as frequently happens with materials ground to a clay fineness, a hanging cloud was produced with most of the particles forming as aggregates on the upper-leaf surface, and electrostatic charges varied from 0 to 500 volts. Little or no dust settled on the underleaf surface and the control was poor. (2) If the average particle size was 50 to 100 microns, no dust cloud developed. Charges of 3,000 to 4,000 volts were produced if the mineral composition of the sample was satisfactory but because of too few particles in a given amount of dust, there were few particles on the underleaf surface and the control was poor. (3) When the average particle size was from 10 to 30 microns, charges from 1,500 to 3,000 volts were developed and the dispersion on both the upper and lower leaf surfaces was approximately equal with from 5 to 10 particles per square millimeter of leaf surface and the control was good.

A similar variation in dust coverage was found with aphids on the dusted plants. Under some conditions the aphids would have many dust particles on them, while under other conditions some aphids would not be touched with a single particle. In the case of clay dispersants (fine particles), aphids in exposed positions might be heavily covered with a deposit of dust, but the dust did not seem to be highly effective. Therefore two questions had to be answered.

(a) Can particles of rotenone be so thickly covered with minute particles of a dispersant that the ro-

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[1] Contribution from Wis. Agr. Exp. Sta. Published by permission of the Director. Complete text will appear in Vol. 39 of Proceedings of Wis. Acad. Sci. Arts and Letters.

[2] Professor of Economic Entomology, and Associate Professor of Soils, respectively.

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tenone does not come in contact with the insect?

(b) Are electrostatic charge effects important in causing a separation and wide dispersion of dust particles to all parts of the plant and to insects on the underleaf surfaces?

In a preliminary study of a few dispersants it was observed that when two chemically different dispersants of opposite charge were mixed, the charge for the combined materials was less than that of each material taken separately. When different materials were tested for sign of charge it was found that (+) or (—) charges were developed according to the mineral composition of the material. Additional observations led to the conclusion that the mineral composition of a dust determines the sign of the charge and that the magnitude of the net charge per gram of material developed is determined largely by particle size. Preliminary observations have been reported from this Station.

Effect of Electrostatics

IF AN insecticidal dust produces or acquires an electrostatic charge when blown through a dust blower it is to be expected that each dust particle having the same charge will tend to be repelled from all particles of the same charge. When the dust cloud first breaks from the nozzle end of the dust blower the momentum of the air stream will tend to hold the dust cloud together. But as the velocity of the air stream diminishes, the particles separate or disperse and move more independently. If the developed charge is weak, the repulsion between particles will be small and little or no dispersion of dust particles occurs. If the charge is strong, dispersion will be increased and the dust particles are made to strike a plant or insect singly rather than in aggregates. Theoretically as the dust cloud approaches a plant, a charge opposite that of the dust cloud is induced on the plants and insects. This in turn causes the dust particles to be attracted to both plants and insects and causes the particles to cling more closely after contact. A diagrammatic representation of this phenomenon is shown in figure 1. The passage of electrons down the plant stem during the dusting of its upper leaves was verified by registration of charges on an electrostatic voltmeter attached to the base of the plant (insulated from ground).

To study the factors involved in the production of electrostatic charge effects in dust streams, it seemed necessary to determine the behavior of different minerals and combinations of minerals. A collection of samples containing the materials commonly found in insecticidal and fungicidal dusts was then obtained and examined for electrostatic effects. In making this study it was found that each mineral or combination of minerals always produced characteristic measurable electrostatic charge effects in dust clouds when blown through a dust blower unit.

With standardized conditions of measurement employed, the magnitude of charges obtained depend upon the material, the size of grinding and upon the conditioning treatment. The potentials registered varied from 0 to an estimated 50,000 volts or more (0 to 5,000 e.s.u. of charge per gram of dust). The materials tested were in part purchased from Ward's natural Science Establishment and others came from departmental collections. A few standard U.S.P. chemicals were tested.

Equipment and Procedure

IN STUDYING the electrostatic effects of the different materials tested the same equipment and method of procedure was used as described by Wilson, Janes, and Campau.** The method consists of blowing a standardized volume of dust through a specially constructed copper dust blower shown in figure 2. The charges imparted to the blower were determined by the readings of an electrostatic voltmeter recording from 0 to approximately 14,000 volts.[3] Humidity of the air was found to affect the degree of electrification to such an extent that samples giving readings up to 8,000 volts might produce only 4,000 volts at 50 per cent relative humidity and drop to zero when the humidity increased to 75 per cent. All readings reported were made with room temperatures between 80 and 85° F. and relative humidity between 30 and 40 per cent. In most cases readings were obtained with samples ground to pass through a 325-mesh screen. In a few cases where charges could not be ob-

** Wilson, H. F.; Jones, R. L. and Campeau, E. J., Electrostatic charge effects produced by insecticidal dusts. Jour. Econ. Ent. *37*, 651-655, 1944.

3 As previously noted, all voltage readings quoted in this paper refer to 0.5 gm. samples and a 17 MMF system. If V is voltmeter reading (volts), the equivalent charge per gram of dust is therefore $(34 \times 10^{-12} V)$ coulombs/gm or $(102 \times 10^{-3} V)$ esu (approximately $1/10V$ (esu)).
gm. gm.

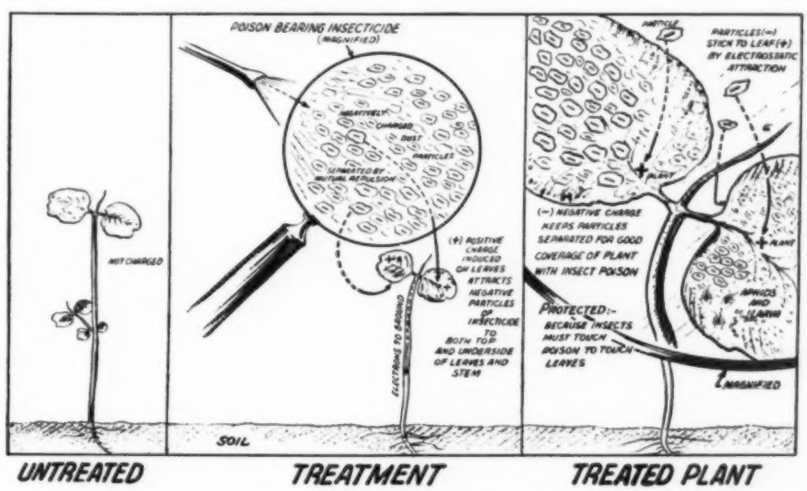
POISON BEARING INSECTICIDE
(MAGNIFIED)
NEGATIVELY CHARGED DUST PARTICLES
SEPARATED BY MUTUAL REPULSION
(+) POSITIVE CHARGE INDUCED ON LEAVES ATTRACTS NEGATIVE PARTICLES OF INSECTICIDE TO BOTH TOP AND UNDERSIDE OF LEAVES AND STEM
ELECTRONS TO GROUND
NOT CHARGED
SOIL
PARTICLES(—) STICK TO LEAF(+) BY ELECTROSTATIC ATTRACTION
(—) NEGATIVE CHARGE KEEPS PARTICLES SEPARATED FOR GOOD COVERAGE OF PLANT WITH INSECT POISON
PROTECTED:- BECAUSE INSECTS MUST TOUCH POISON TO TOUCH LEAVES
MAGNIFIED
UNTREATED
TREATMENT
TREATED PLANT

Fig. 1. The effect of a "charged" insecticidal dust. A frictional charge is produced in the dust cloud which tends to separate the dust particles. A charge of the opposite sign induced on the plant attracts the particles and causes closer adhesion.

How Pennsalt's Natural Cryolite SAVED THE PEANUT CROP!

1 In the wiregrass section of the southeastern peanut belt, this healthy patch was duplicated over 1,000,000 acres of peanut land . . . promising a bumper crop of one of Dixie's agricultural mainstays. But then . . .

2 . . . the dreaded velvet bean caterpillar struck . . . disaster threatened! With incredible speed, this voracious pest defoliated plant after plant, acre after acre . . . almost before the eyes of the helpless farmers. Desperately the goober growers flashed an urgent appeal for cryolite: could Pennsalt supply sufficient Kryocide to stem the tide?

3 Pennsalt could . . . and would. In anticipation of just such an emergency Pennsalt maintains huge stocks of Kryocide at Natrona, Pa., at all times. But time worked in favor of the caterpillar . . . Natrona is 600 miles from the heart of the stricken area. In this race against time, a giant American Airlines DC-4 was pressed into service, rushed to the embattled district with a 10-ton load of the powerful insecticide.

4 Within 60 hours after the SOS went out, 50 tons of natural cryolite had been flown to the peanut growers, transferred to dusting planes, and dusted over the plants. What's more, six trailer trucks and 35 freight cars were rumbling southward with additional supplies. The battle was on!

5 In a week the tide had turned—the fight was won, the bumper peanut crop saved. Alabama entomologists who had taken charge of the campaign, deemed the situation stable enough for them to return to their headquarters advising that the infestation was under control. The speed with which Pennsalt met the emergency was undoubtedly a great factor in saving the crop.

There—in a nut shell—is a story of Pennsalt service . . . *and* the story of Kryocide, a powerful insecticide made from natural Greenland cryolite. Widely used by fruit growers, truck farmers and home gardeners, Kryocide is one of a complete line of Pennsalt chemicals used by agriculture.

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Emulphor DDT obviates the use of excessive amounts of solvent.

Sample and formula will be furnished on request.

Dyestuffs specially selected for the coloring of DDT insecticide are available.

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tained with 325-mesh samples, somewhat larger sized particles were used.

Fine powdered materials, for which the sign of charge had been previously established were used as reference materials, namely: an impure pyrophyllite (comercially known as "Pyrax"),[4] quartz, (SiO_2 crystals) and pure talc ($Mg_3Si_4O_{10}(OH)_2$) all with (—) charges, and calcite, $CaCO_3$ and a micaceous mineral designated commercially as "AA Mica" both with (+) charges.

In the apparatus used it was possible to hold the charge on the voltmeter after a dust charge measurement, and then to place an additional charge on the dust tube by dispersing a second sample and transmit it additively to the voltmeter. If the second sample gave the same sign of charge as the first, the charge on the voltmeter was increased. But if the charge on the second material was of the opposite sign as the first, the charge on the voltmeter was reduced. By alternating one or several of the five reference dusts with the test sample, it was possible to determine the sign of charge for a wide variety of materials tested.

Trends which appear rather definitely established by present observations may be summarized as follows:

1. Three native ores common to insecticide dispersants developed (+) charges.
2. Three sulfides of metals used in insecticidal dusts as carriers for toxic metals developed no charges on the dust but were shown to be (+) in reaction because they depressed the negative reference material, quartz. One mineral sphalerite (Zn S) developed (—) charges.
3. Six minerals of the haloid group in which the fluoride compounds occur were found to be weakly positive in reaction. Cuprichloride appeared in additive tests to be (—) in reaction.
4. Carbonates and oxides of metals all became positively charged.
5. The oxides of silicon were found to be the main source of (—) charges in minerals. However, with the silicates, the charge developed was (+) or (—), probably depending upon crystal lattice factors and the balance between the silica component and the basic components Na_2O, CaO, MaO, MgO, and other oxides. The micas in highly pure forms, muscovite and biotite, were weakly (+) but a sample of commercial mica which may have contained small amounts of impurities was strongly (+) as was the micaceous reference material "AA Mica."
6. The sulfate group was found difficult to characterize because no direct charges could be obtained except for gypsum. The charge for this material was definitely (+). A sample of Glauber's salts gave no sign in itself but appeared to be negative in mixtures with calcite or quartz.
7. The acidic materials tend to develop (—) charges, as exemplified by the two alums, the two types of organic acid crystals, and by silicon dioxide as already mentioned.

[4] Mineralogical characterization reported by Wilson, H. F., and Jackson, M. L. "Mineral Composition and Particle Size of Insecticidal Dispersants and their Influence on Toxicity of Rotenone Dusts." Jour. Econ. Ent. 39 pp. 290-295, June, 1946.

TABLE 1—Electrostatic charge resulting from mechanical mixtures of finely ground minerals.

Material tested and charge A	*Reference material and charge before mixing* B	*Weight ratio* A : B	*Electrostatic charge produced when combined* volts
Albite (+)4000	"Pyrax" (—)7900	1 : 1	(—) 9000
	"AA Mica" (+)7600	1 : 1	(+) 3000
Almandite O(+)	"Pyrax" (—)7900	1 : 1	(—) 9000
	"AA Mica" (+)7600	1 : 1	(+) 2600
Hornblende (+)2500	"Pyrax" (—)7900	1 : 1	(—) 9600
	"AA Mica" (+)7600	1 : 1	(+) 2200
Rhodenite (+)4550	"Pyrax" (—)7900	1 : 1	(—) 8500
	"AA Mica" (+)7600	1 : 1	(+) 2500
Manganite (+)2000	"Pyrax" (—)7900	1 : 10	0
	"AA Mica" (+)7600	1 : 1	0
	"AA Mica" (+)7600	1 : 3	(+) 300
	"AA Mica" (+)7600	1 : 6	(+) 4000
Smithsonite (+)5900	"Pyrax" (—)7900	1 : 50	(—) 4850
	"AA Mica" (+)7600	1 : 1	(+) 7800
Sulphur O(+)	$CaCO_3$ (+)14000	1 : 1	(+)14000
	"AA Mica" (+)7600	1 : 1	(+) 9000
	"Pyrax" (—)7900	1 : 1	0
	"Pyrax" (—)7900	1 : 2	(—) 200
	"Pyrax" (—)7900	1 : 3	(—) 1000
	"Pyrax" (—)7900	1 : 10	(—) 3100
Tremolite "talc" O	"Pyrax" (—)7900	1 : 1	0
	"AA Mica" (+)7600	1 : 1	0
Steatite talc O(+)	A pure talc (—)7800	1 : 2	(—) 5000
	A pure talc (—)7800	3 : 1	0
	A pure talc (—)7800	4 : 1	(—) 100
	A pure talc (—)7800	5 : 1	(+) 1500
	A pure talc (—)7800	7 : 1	(+) 3000
Barium carbonate U.S.P. O(+)	A pure talc (—)7800	1 : 1	0
	A pure talc (—)7800	1 : 25	(—) 400
	A pure talc (—)7800	1 : 50	(—) 2200

Synergistic Charges

THE electrostatic charges obtained with mechanical mixtures of two components are recorded in table I. As a general trend, when two minerals displaying the same sign of charge were mixed together, the accumulation of charge for the mixture was higher than for either material alone. If two materials displaying opposite sign

(*Turn to Page* 49)

Control aphids, "red spider" and citrus mites

Hexaethyl Tetraphosphate

Monsanto: first commercial producer in the U. S.

Hexaethyl Tetraphosphate (known in Germany as "Bladan") is one of the more recent chemical compounds made commercially available by Monsanto in the United States . . . It has been found valuable as a check on the vast damage done annually by aphids, "red spider" and citrus mites; it also shows promise as a control for other damaging insect pests.

Preliminary tests indicate that Hexaethyl Tetraphosphate is most effective in an emulsion form. Typical emulsions for spraying may be prepared by dissolving Hexaethyl Tetraphosphate in a suitable solvent, such as xylene, and incorporating an emulsifying agent. This solution may then be added to water in the proper concentrations to form the emulsion.

Samples and available information will be supplied . . . Write MONSANTO CHEMICAL COMPANY, Organic Chemicals Division, 1700 South Second Street, St. Louis 4, Missouri.

EMPIRICAL FORMULA:
$C_{13}H_{30}O_{13}P_4$

TABLE OF PROPERTIES	
APPEARANCE:	Tan to dark liquid.
SPECIFIC GRAVITY:	Approximately 1.3 or 10.7 lbs./gal.
CRYSTALLIZING POINT:	Solidifies at approximately minus 40°C.
BOILING POINT:	Decomposes above 150°C.
SOLUBILITIES:	Miscible in water, acetone, alcohol, benzene, carbon tetrachloride, chloroform, diacetone alcohol, ethyl acetate, glycerine, ortho-dichlorobenzene pine oil, toluene, xylene, alkyl naphthalenes, etc. Not miscible in kerosene or petroleum ether.
STABILITY:	Tests presently under way indicate that Hexaethyl Tetraphosphate as such is stable, but when diluted in water slowly hydrolyzes. Pending completion of these tests it is recommended that spray solutions be used within four hours after dilution.
TOXICITY TO ANIMALS:	Preliminary tests on rats indicate that Hexaethyl Tetraphosphate is toxic to warm-blooded animals. Until further information is developed all due precaution should be observed in the application and handling of this chemical and its formulations to avoid skin contact or accidental ingestion.

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Experiment Station Digest

By H. H. Slawson

USE of chemicals for artificial defoliation of cotton plants in fields where mechanical cotton pickers are to be used was investigated at the Arizona Agricultural Experiment Station, Tucson, Ariz., last year, according to the station's annual report. Calcium cyanamide at 250 and 140 lbs. to the acre and "Dowfrost" at 312 and 47 lbs., were applied to the Acala variety of upland cotton, says the brief progress report, which continues:

"Practically all the leaves were killed or caused to drop from plants treated with both rates of application of the cyanamide. The heavier rate of application of the 'Dowfrost' was not quite so effective as the cyanamide and the 47-lb. application of 'Dowfrost' caused but relatively few leaves to fall."

Applications of 15 and 30 lbs. of calcium cyanamide to another cotton variety, the Wilds, killed all leaves and most of them fell. "Dowfrost" at 30 lbs. caused almost as good a kill and drop of leaves as the cyanamide, but the 15 lb. application was less effective. Applications of 15, 30, 40 and 60 lbs. of calcium cyanamide were used on Acala, but leaf drop was not satisfactory with any of them. Use of various commercial mixtures of calcium cyanamide, with and without sticking agents, was found ineffective on the SxP cotton variety, although the heaviest application was only 60 lbs. per acre. Conclusions were reached that heavier applications were required in Arizona than the 30 lbs. per acre recommended for use in the cotton belt proper.

Seed Protectants

"EXPERIMENTS On the Use of Vegetable Seed Protectants" is the title of a bulletin, No. 361, issued by South Carolina Agricultural Experiment Station, Clemson, S. C., which summarized results of lengthy tests with a varied list of chemical seed protectants on seeds of fourteen vegetables. Results from use of specific products are given and a table of recommended protectants for each of the vegetables is provided. Manufacturers who supplied the chemicals for this study are listed as the following: duPont Semesan Co.; E. I. duPont de Nemours & Co.; Naugatuck Chem. Div. of United States Rubber Co.; Rohm & Haas Co.; Virginia Smelting Co.; Dow Chemical Co.; and F. W. Berk & Co. Chloropicrin used in some tests was furnished by Innis, Speiden & Co.

Texas Agricultural Experiment Station, at College Station, Tex., in its 1945 review of station activities, reports that various toxic chemicals were successfully used to eradicate mesquite, common pest of the southwestern cattle ranges. Ammonium sulfamate, sodium arsenite or sodium chlorate were sprayed on foliage of sprouts which appeared after the top brush had been cut. Under conditions of high humidity and heavy dews these chemicals penetrated through the leaves into underground stems and killed the tree. But, if air humidity was low and heavy dews were absent when the chemicals were applied, complete failure to kill the sprouts resulted. The method was therefore not recommended until ways to use the chemicals over a wider range of weather conditions can be developed.

Successful eradication of mesquite, the report explains, depends on destruction of the dormant sprout buds on underground stems of trees. Removing the top wood at soil level and painting the sapwood of the stump with sodium arsenite was found highly effective and only half as costly as the traditional hand grubbing process. Use of kerosene, Diesel fuel or similar oils was found "wasteful" where applied to above-ground growth and effective only when sufficient amounts were applied to the ground and underground stems of mesquite to soak through the bark and into all dormant buds.

Improper cleaning and sterilization of rubber parts of milking machines have been found by investigators at Missouri Agricultural Experiment Station, Columbia, Mo., to be a serious source of bacterial contamination of milk. Studying milking machines on 65 farms as a source of heat resistant bacteria, 60 per cent of the farms were found using an alkali solution of sub-standard concentration for treating rubber parts of the milker with a resulting high bacterial contamination. It was recommended that the cleaning solution should contain a minimum of 0.4 per cent of sodium hydroxide. To prevent formation of sediment in alkali solutions, use of soft water and lye with a low sodium carbonate content was advised. If salt is added to prevent freezing, it should be chemically pure, the report suggests.

2,4-D Experiments

EXPERIMENTAL work with 2,4-D, conducted by Nebraska Agricultural Experiment Station at various localities in that state, have indicated that this product, in the judgment of the investigators, is capable of largely eliminating a number of lawn weeds. Listed in a progress report on the project, included in the station's annual report for 1945, were the following weeds, susceptible to control by 2,4-D: dandelions, Rugel's plantain, chickweed, yellow trefoil, henbit and "several other" broadleaf weeds, not named. Grassy weeds, however, such as crabgrass, yellow and green foxtail, barnyard grass and nimbleweed, are not affected, the report states.

In extensive tests on bindweed in field crops, results varied from 88.5 to 99.5 per cent reduction of top growth in one locality to zero per cent reduction in all plots treated at another location. Reasons for this wide range of effectiveness were not determined. In general, according to the report, all products containing 2,4-D were "nearly equal in effectiveness at most locations," while concentrations

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of 1,000 to 1,500 ppm. were more effective than 500. Root kill was not equal to top growth kill, as both vertical and horizontal roots remained alive, though stunted, in all plots treated.

Canada thistle was found "moderately resistant" to 2,4-D as was true also of whiteweed, while tanweed proved "quite resistant." The report includes lists showing the relative susceptibility of numerous weeds to 2,4-D.

Soil Survey in Utah

FROM the Utah Agricultural Experimental Station, Logan, Utah, the quarterly issue of its publication *Farm & Home Science* presents a story of the soil survey of the Salt Lake area. Although the survey ended in 1936, ten years has been required to assemble and correlate the data and publish the findings. Soils were grouped into classification units on the basis of their characteristics, their underlying formations, and how they influence growth of crops in different areas of the state.

In arid areas, such as Utah, a portion of the work of soil survey consists of sampling the soil in representative localities, and determining the content of soluble salt in the soil. Samples are taken from the surface, the subsurface and the subsoil, to a depth of six feet where possible. From these samples, an alkali map is made which classifies the alkali concentration in the soil into areas which are practically free from soluble salt (below 12 per cent), up to areas with strong concentration (above 65 per cent). It was found that approximately 42 per cent of the area has little or no alkali. This represents about 120,000 acres.

The experiment station quarterly also reports efforts in breeding for wilt resistance in tomatoes, describing how various steps have been taken to develop such tomatoes which at the same time have high value commercially. Dr. H. Loran Blood, pathologist with the Bureau of Plant Industry, reports his efforts to develop fruit resistant both to verticillium wilt and to curly top. Some years ago he brought from South America some wild varieties of tomatoes with hopes that a cross breed would produce the desired characteristics. While some of these varieties show high resistance to the diseases, hybrids have not yet been developed which possess all the qualities needed for fruit of high value commercially, the article states.★★

BISHOPP

(*Continued from Page* 22)

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since that publication appeared. At the Orlando, Fla., laboratory of the Bureau of Entomology and Plant Quarantine it was found that the toxicity of "1068" was practically identical with that of DDT to larvae of the malaria mosquito (0.01 p.p.m. killed 98.3 per cent in each case in 48 hours). At the same laboratory "1068" was found to be outstanding against the body louse but less persistent than DDT or 3956. The Beltsville laboratory found "1068" applied as a powder to be more toxic to the German cockroach than DDT. In preliminary laboratory tests Bureau entomologists found "1068" to be much less toxic to the armyworm, celery leaf tier, and variegated cutworm than DDT. Against the pea aphid they found that 10 per cent "1068" was more toxic than 1 per cent nicotine and 2 per cent "1068" less toxic than 1 per cent gamma-benzene hexachloride. Against the red spider 10 per cent "1068" was more effective than sulfur. It was also found that 8 pounds of "1068" to 100 gallons of water applied as a spray to 5 species of vegetables showed no injurious effects.

Sprays containing 5 to 20 ml. of "1068" per gallon of water, applied at the rate of 1 gallon per square yard, killed all Japanese beetle larvae. This material showed some promise against the tarnished plant bug on cotton and lygus bugs on alfalfa. In Arizona the results obtained with "1068" applied as a dust or a spray against grasshoppers in alfalfa were heartening. A dosage of 1 pound per acre killed 90 to 100 per cent of the grasshoppers present at the time of treatment and continued to kill newcomers for at least 2 weeks.

An emulsion of "1068" atomized on corn ears showed promise against the corn earworm, and a water-dispersible, or wettable, form gave excellent residual action against the confused flour beetle.

DDT Discussed

WHILE DDT must still be regarded as a new insecticide, so much research on it has been carried out and published that I shall not discuss it here. Many of the promising results obtained in early small-scale tests have been realized in practical field use, and some of the hopes of the over optimistic—that DDT would be an answer to all insect problems—have been dashed. The principal deterrent to the more extensive field use of DDT is the fear of residues that may be detrimental to man. More extensive experimental work and time are necessary to get full answers to this and other questions upon which light is needed.

The failure of DDT to control mites and some aphids on plants, and indirect aid lent by DDT to the development of those pests through its destructive action on beneficial insects, make it necessary to consider mite killers. The development of an effective miticide, especially one which can be used along with DDT or other insecticides with similar action, is an urgent need.

To meet the mite problem our laboratory at Yakima has tried among other things combinations of DDT and xanthone as a codling moth spray, with encouraging results. The favorable results obtained by Jeppson of the California Citrus Experiment Station with bis(4-chlorophenoxy)methane against the citrus red mite suggest the desirability of early trials of this material against other orchard mites.

Analogs of DDT

THE methoxy analog of DDT (1-trichloro-2,2-bis(*p*-methoxyphenyl)ethane) was found ineffective against body lice and much less toxic than DDT to malaria mosquitoes (larvae and adults) and to houseflies.

In tests made last year against the Mexican bean beetle a 10 per cent dust appeared to be as effective as 0.5 per cent of rotenone. Although this

material exihibited good killing action on grasshoppers in Wyoming last year, it did not give economic control of those pests in alfalfa in Arizona this year even in dosages as heavy a 1.5 pounds per acre applied as a dust or spray. It was found much less effective against white-fringed beetles, lygus bugs, and the European corn borer than DDT, but appeared to be as effective as DDT when used as a 5 per cent residual spray against stored-grain pests. It was much less effective against the codling moth than DDT at comparable strengths. White-fringed beetles were knocked down quickly with a spray containing 2 pounds to 100 gallons and they all died, though slowly.

The distinct insecticidal value of this analog against many pests and its reported lower toxicity to higher animals is encouraging its development.

The para-para prime fluorine analog of DDT, designated as Gix by the Germans, has shown considerable toxicity to body lice, mosquitoes, flies, and cockroaches but much less than has DDT. Although the Germans consider this material to be superior to DDT as an agricultural insecticide because of its quicker action, it is less toxic to insects and the cost of making it is far greater than that of DDT: therefore, it does not seem worthy of much further consideration.

Hydroxypentamethylflavan

HYDROXYPENTAMETHYLFLAVAN (2'-hydroxy-2,4,4',7-pentamethylflavan) has given rather erratic results in tests against the Mexican bean beetle. As a 10-per cent dust it prevented corn earworms from penetrating ears of corn. When applied to soil at rates of 2 to 8 pounds per acre it gave such excellent control of chiggers as to encourage further tests against plant-infesting mites. Laboratory tests against the two-spotted mite carried out by Siegler showed this flavan compound (4 pounds of 25 per cent wettable powder in 100 gallons) to be about equal to 2 gallons of lime sulfur with a wetting agent to 100 gallons.

Considerable attention has been directed to synergists, or activators, especially to supplement or extend pyrethrum. This appears to be a fertile area for further research, since any material that will materially cut the cost of pyrethrins will be most acceptable, especially in the agricultural field. Substituted piperonyl cyclohexenones have been commanding increased attention recently and some tests indicate that some of the piperonyl compounds have insecticidal value aside from their synergistic effect on the pyrethrins. One of these, piperonyl butoxide, has also exhibited repellent action against horseflies.

In closing I want to express the appreciation of the Bureau of the hearty cooperation given by industry during recent years. I should like also to emphasize again the preliminary nature of the results presented and the fact that many of the tests this season are not yet complete.

Also that most of the results presented are those obtained by workers in the Bureau of Entomology and Plant Quarantine and that no serious attempt has been made to gather unpublished data from State or industrial investigators. It is not unlikely, therefore, that quite different results may be forthcoming from some quarters. It should also be reiterated that this review makes no claim at an enumeration of all the new insecticides of promise, nor of listing all of the pests against which these insecticides are showing encouraging results.

With all the attention being given to new insecticides, we should not be led to the conclusion that the old, time-proven materials are being replaced. True some inroads into the fields occupied by old insecticides will be made by these newcomers, but where the old ones are available and really effective they will hold their own. It is also likely that competition will cause some downward adjustment in prices. Recent insecticide developments are greatly broadening the field of use of insecticides and causing the public to become more insect and insecticide conscious.

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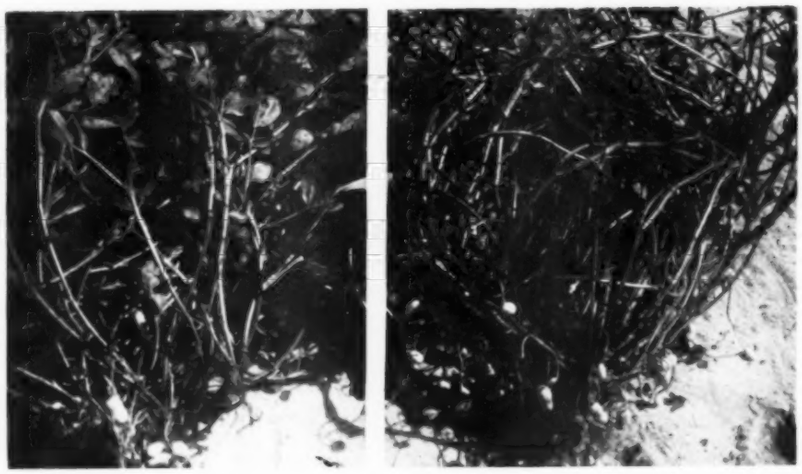
"Kryocide" Helps Save Big Peanut Crop



Graphic portrayal of how velvet bean caterpillar completely defoliates peanut vines is seen above (right). The vine at the left was treated with cryolite insecticides which prevented further destruction of leaves, although slight damage by the caterpillar can be seen in spots on the plant. These pictures were taken in the Wiregrass section of the southeastern peanut belt which last month was threatened with complete destruction from heavy infestation of insects. Shipment of 2,250,000 pounds of "Kryocide" from Pennsylvania Salt Manufacturing Co., is credited with playing a major part in controlling the pest.

The Listening Post

This department, which reviews current plant disease and insect control problems, is a monthly feature of AGRICULTURAL CHEMICALS. The following comments on current plant disease problems are based on observations submitted by collaborators of the Plant Disease Survey. The following summary of their most recent reports was prepared especially for this magazine.

By Paul R. Miller

A DESTRUCTIVE epiphytotic of onion mildew (*Peronospora destructor*) developed in Lafourche and Terrebonne Parishes (two of the most important onion-producing Parishes) in Louisiana this spring. The growers in this area were just getting back into full production of onions again this year after the last disastrous mildew epidemic (1942). The disease caused some damage in most onion-producing sections, but was especially destructive along lower Bayou Lafourche. The unusually warm, wet weather in March was especially favorable for mildew development. More than 15 inches of rain fell in the lower Lafourche section in March. During April, in addition to heavy rains, there were many cloudy, foggy days. The disease spread rapidly and caused most severe damage following heavy rains accompanied by blustery winds.

Mildew was first observed about the first of March in two small fields. By March 15, the disease had spread over widely scattered areas on shallots as well as onions. On March 26, three onion fields were observed with only occasional mildew-infected plants. The following day a six-inch rain fell accompanied by high winds. A week later (April 2) practically every plant in each of the three fields was diseased. Within two weeks the plants were so badly damaged that practically all growth had ceased.

The numerous small plantings of onions grown for seed were practically wiped out in the lower Lafourche area. Most of the onions in this area were killed prematurely this year. Mildew caused most of the early killing of the tops, but unusually heavy thrip infestation also caused considerable injury. The losses varied from 40 per cent in the lightly infected fields to at least 75 per cent in the more severely affected area. The average loss approximated 60 per cent in the numerous fields observed in the Terrebonne-Lafourche section with an estimated 1500 acres of onions.

A spray test was carried on this spring in the midst of the worst mildew infected area of the State. A block of onions was selected for the test just across a small ditch from an older onion field that showed heavy mildew infection. When the spray test was started (March 15) there was only an occasional infected plant in the test plots. Sprays were applied at weekly intervals except when heavy rains interfered, until April 23. At this time the plants were so badly injured as to make further applications useless.

Small plots were used consisting of beds 25 feet long with 3 rows of onions on each bed. The plots were randomized and replicated 5 times. The following mixtures were used: "Zerlate," 3 lbs. per 100 gal.; "COCS" spray (3-100); "Dithane" (2-1½-100); bordeaux mixture (4-4-50) ready prepared; lime-sulfur, 2%; bordeaux 4-4-50 + DDT (2-100); DDT (2-100); and "Tennessee Copper Dust A." A suitable sticker-spreader consisting of rosin soap 1% and a duPont soap spreader ¾ lb. to 100 gal. was added to all the spray mixtures, using a knapsack sprayer with excellent results.

(*Turn to Page* 43)

Insect Conditions in September

By G. J. Haeussler

This column is prepared especially for readers of AGRICULTURAL CHEMICALS. Mr. Haeussler is in charge of Insect Pest Survey and Information, Agricultural Research Administration, Bureau of Entomology and Plant Quarantine, U.S.D.A. His observations, based on latest reports received by the Bureau from collaborators all over the country, will be a monthly feature of AGRICULTURE CHEMICALS.

THE present discussion summarizes briefly the situation during the period from August 15 to September 15 with regard to some of the more important crop pests against which insecticides are used.

The boll weevil reached its peak in most areas shortly after mid-August and has caused serious damage to green bolls on late cotton. During the remainder of the period it continued to spread to new fields in the northern areas and infestations increased rapidly in Virginia, North Carolina, Tennessee and northern Arkansas. Some dusting of late cotton with calcium arsenate was done to protect the green bolls.

By the middle of September, the cotton leafworm had been found in twelve States: Arizona, New Mexico, Texas, Oklahoma, Louisiana, Arkansas, Missouri, Illinois, Mississippi, Alabama, Tennessee, and Georgia. It reached Georgia, where worms were found August 27 in Mitchell County, too late to cause serious damage. Its occurrence in southern Illinois was likewise too late to cause damage. Calcium arsenate dust was applied in heavily infested fields in most states and, although no serious damage was reported, growers were cautioned to be prepared to apply insecticides promptly to young cotton when the leafworms appeared in large numbers.

The bollworm situation has remained serious. Bollworms appeared in injurious numbers in many places during the last half of August, but were especially injurious in Texas, Oklahoma, Louisiana, Arkansas and Mississippi. Thorough and prompt dusting with 5% DDT, or cryolite, or

calcium arsenate were the recommended treatments.

No reports of serious damage to apple from codling moths have been received and, in fact, the information at hand up to the middle of September indicates that in most areas the amount of injury caused by this insect has been considerably less this year than usual. European red mites, although continuing abundant through August and early September in most eastern and mid-western apple growing areas, were generally on the decline. Infestations appear to have been somewhat more injurious than during previous years; however, reports from some areas indicate that the mite populations were equally severe in orchards sprayed with materials other than DDT as in those sprayed with that material.

Infestations of cabbage caterpillars, which had decreased to relatively low levels in most states during early August, began to respond to the seasonal influence toward the end of the month and showed a marked increase in numbers. During the first half of September they were present in moderate to heavy abundance in parts of New Jersey, Virginia, South Carolina, northwestern Tennessee and Wisconsin, with light to moderate populations present in a number of other states. The fall armyworm and cutworms damaged cabbage and related crops in parts of Virginia and South Carolina during the latter part of August and early September.

The tomato hornworm was reported causing considerable damage to peppers in Maine toward the end of August. The second generation began to appear in New Jersey in early September and very high populations of the larvae were present in some tomato fields. Armyworms moving from alfalfa caused serious damage to tomatoes in northern Utah early in September.

Beetles on East Coast

MEXICAN bean beetle infestations have been diminishing in intensity since mid-August in the Atlantic Coast States from Maryland to Maine, and only light infestations have been present in Nebraska, Wyoming and northern Utah. Moderate to heavy infestations still persist in the coastal regions from Virginia to Alabama and in northwestern Tennessee. No additional infestations of this insect have been found in Ventura County, California and repressive measures that have been undertaken have greatly reduced the population. Several other species of insects are attacking beans in varying degrees of intensity in the southern and eastern part of the country. These include the bean leaf beetle, southern green stinkbug, corn earworm, cucumber beetles and the bean leaf roller. Eggs, moths, and larvae of the corn earworm were reported numerous early in September in many fields of snap and lima beans in eastern Virginia, requiring insecticide applications. The bean looper is also present in eastern Virginia in greater abundance than for the past several years. Complaints of cutworms feeding on beans were reported from south central Idaho. Moderate to heavy populations of the potato leafhopper were reported on beans in Wisconsin early in September, but populations in New Jersey and eastern Virginia are on the decline.

Infestations of the velvetbean caterpillar became general in late August and early September throughout the peanut areas in northern Florida, southern Alabama and southern Georgia. A loss to peanuts of at least 10 per cent has resulted in southwest Georgia, the most critical area. In late August stripping of soybeans occurred in southwestern Louisiana, northward to Rapides and Concordia Parishes. A few worms were observed on soybeans in Harrison, Humphrey and Sharkey Counties of Mississippi the first week of September. Several infestations on soybeans were reported from scattered counties in South Carolina in late August and early September, but damage was not extensive. In early September a few worms were observed on soybeans in several counties in southern North Carolina and in southeastern Virginia. Damage was reported not to be severe. Cryolite supplies were generally reported adequate to meet requirements for control of the velvetbean caterpillar in all affected states except Georgia. A few reports from Georgia and Florida indicated that excellent results were being obtained from the commercial use of DDT dusts.

Cotton Aphids in Force

DURING the last half of August populations of the cotton aphid were reduced by parasites and disease in some fields in Texas and Arizona. Aphids caused serious damage to cotton in some parts of Texas, southeastern Arkansas and in the Mississippi Delta and were also reported from Georgia, South Carolina, and Arizona. The tight nicotine supply emphasized the importance of the cotton aphid as a serious cotton pest.

Aphids continued troublesome into early September on cole crops in New Jersey, Virginia, South Carolina, and northwestern Tennessee. They were reported present in lighter numbers on these crops in Wisconsin, Utah, and southern California.

Potato aphid populations began to decline toward the end of August in the critical potato-growing districts of Maine, but at that same time were reported causing injury to potatoes in New Jersey. An increase of this pest developed on potato and tomato in Ohio early in September.

An outbreak of the potato leafhopper which developed early in August in Wisconsin, Minnesota, and North Dakota decreased toward the end of that month and populations continued to decline generally in early September. A severe infestation of the flea beetle was reported on late potatoes in central Washington the first week of September.★★

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New Sulfuric Acid Plant

A new sulfuric acid plant at Charleston, S. C., was scheduled for completion in October, according to officials of A. F. Pringle & Company, Inc. of Charleston, for whom the plant is being built.

The new plant, which has been under construction for some months, is to replace the former box chamber acid plant which was destroyed by fire early this year. The new unit consists of six Mills-Packard chambers for manufacturing sulfuric acid.

LISTENING POST

(*Continued from Page* 41)

It soon became evident following some heavy rains that none of the sprays was really controlling the mildew, but the test was continued until there was little green color left in any of the plants. The "Zerlate," bordeaux and DDT plots looked somewhat greener than the others all through the test; however, the yields from all the plots were disappointing. Analysis of variance showed no significant difference in results from the various treatments. This test shows that when conditions are especially favorable for mildew development, the disease is very difficult to control.

New Blight in Oats

A SURVEY of oat fields, made this year, has shown that a new disease, *Helminthosporium* blight, is present over most of Illinois and was very destructive this year in some fields of susceptible varieties. *Helminthosporium* blight is a seed-borne, fungus disease which attacks the plant both in the seedling stage and in late stages when it infects the nodes.

Losses caused by *Helminthosporium* blight vary from field to field, depending upon the amount of seedling blight and the stage of development of the plant when node infection occurs. Reduction in yield was slight in many fields, but some fields were almost complete failures. Many growers report fair yields but low test weights. In several cases the old variety Columbia, which is highly resistant, out-yielded Tama or Vicland when grown in the same field.

Since the spores of the fungus are carried on the seed, all seed oats should be treated. According to Dr. H. C. Murphy of the United States Department of Agriculture at Ames, Iowa, who also has reported the disease as widespread in that State, the seedling phase of the disease can be effectively controlled by treating the seed with "New Improved Ceresan." Seed treatment will not prevent joint infection. However, it is quite possible that there will be less joint infection in fields where treated seed is sown.

In addition to seed treatment, good farm practices such as crop rotation and the use of cleaned seed will help in reducing the amount of infection in next year's crop. Fortunately, there are certain varieties of oats that are resistant to the disease. According to Dr. Murphy, all Bond-hybrid selections, including Clinton and Benton, and such older varieties as Marion, Iogold, Erban and Rickland are resistant. Vicland, Boone, Tama, Fultex, Osage, Cedar and Neosho are susceptible. No *Helminthosporium* blight has been observed on Columbia.

In the field, leaves of infected seedlings have a peculiar green color and a reddish brown stripe 1 to 3 mm wide which runs along one edge of the leaf for the entire length of the blade. Examination of the diseased seedlings shows various stages of rot on the root system, scutellum and even the crown or first node. Severely diseased seedlings die. Less severely diseased seedlings may die at any later stage of development or live to maturity, in which case they are usually weak plants.

In older plants the first sign of infection is a brownish translucence of the infected node followed by a light brown color of the leaf sheath above the affected node. Leaves on diseased plants develop reddish brown stripes in the blades, beginning with the lowest leaf and developing progressively up the plant. Later the affected nodes become black, due to the development of fruiting structures of the fungus. Plants with early infection ripen prematurely. Straw above the diseased nodes is weak and brittle; it breaks over very easily just above the infected joint. A badly diseased field has the appearance of a wheat field with severe fly infestation.

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Tick Remedy

A mixture designated as stock 1037 is recommended for the control of Gulf Coast tick on cattle and sheep. The preparation contains 5 per cent of technical DDT, 47 of rosin, 33 of hydrogenated methyl abietate (Hercolyn), and 15 per cent of dibutyl phthalate. It is applied to the ears of the animals as soon as ticks become numerous. It kills the ticks and prevents reinfestation for 3-6 weeks. One gallon will treat 125-150 animals. C. S. Rude. U.S. Dept. Agr., Bur. Entomol. Plant Quarantine *E-686*, (1946).

WOODRUM

(*Continued from Page* 14)

and regard of the Nation.

"Your achievement had no small part in enabling farmers to increase their efficiency in the midst of war; to increase their production for human use approximately one-third; to make our armed forces the best-fed fighters any Nation ever had; to help maintain the strength of our allies; and to enable the civilians of the United States to improve their own diets."

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If we really want to preserve a world of free enterprise and initiative, we are going to have to struggle for it. Business men must unsheath their swords and enter the conflict, for it is said that "he only is entitled to liberty who is prepared to win it for himself every day."

Men of industry, business and agriculture must support those leaders in government who believe that peace must come with plenty. Support must be given those leaders in Government who subscribe to the formula of free enterprise—a formula that contains the essential ingredients of initiative, incentive and patriotism. ★★

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4. BLACK LEAF 155 WITH DDT—for control of codling moth and certain other insects.

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7. BLACK LEAF DRY CONCENTRATE—used either as a spray or base mixture with carrier for dusting.

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Suppliers' Bulletins

German Fertilizer Report

The Office of Technical Services, U. S. Department of Commerce, in a recent announcement indicates the availability of two reports on German fertilizer production and soil fertility research. They are: PB-18777 (photostat $4; microfilm, 50c; 47 pages) and PB-18913 (photostat $2, microfilm, 50c; 19 pages) Orders for the reports should be accompanied by check or money order, payable to the treasurer of the United States.

The reports discuss German manufacture of a phosphate fertilizer by heating raw phosphate, soda ash, and sand in rotary kilns. German claims for the product indicate that in many soils it is as good as superphosphate, and in acid soils it is even better.

A process is also described as having been developed in 1943 for preparing black peat in a form suitable for use in improving mineral soils. The process involves extruding the plastic peat in a thin sheet onto a belt passing through a kiln, drying the material to a moisture content of 60 per cent, and coarsely grinding the product.

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Insecticide Book

A new 40-page book, "Hercules Products" is announced as being available from the Hercules Powder Co., 945 Market Street, Wilmington 99, Del. The publication contains information describing materials available for industrial uses in the insecticide field.

•

Seagram Booklet

Joseph E. Seagram & Sons, Inc., Louisville, Ky, has issued a booklet covering the subject of agricultural alcohol, and presenting a plan for soil enrichment. It explains proposed methods of converting surplus farm products into fuel alcohol and utilizing the by-products of alcohol-making for animal feeding. It brings out the international problems involved in such a consideration, and concludes that "by bringing together the tremendous resources of both agriculture and industry, which have been developed so brilliantly in America, we can do more than the statesmen to settle the restless spirit of those nations that resentfully call themselves the 'have-nots'."

•

"Tritons" Are Described

The August, 1946 issue of Rohm & Haas *Reporter* tells of progress of synthetic emulsifiers and wetting agents for use in insecticides. It reports the use of "Tritons" in aqueous sprays for livestock, residual-action sprays for barns and agricultural sprays using DDT wettable powders and emulsions. "Tritons," designated by code numbers, are described for various uses in the insecticide field. In fruit spraying use of the preparation is also described, and a chart is published giving the name of the "Triton," its characteristics, description, and uses.

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Sharples Booklet Out

Sharples Chemicals, Inc., Philadelphia, has published a new booklet. "Sharples Synthetic Organic Chemicals" listing its commercial products and describing products now in the semi-commercial or laboratory stage of development. The company states that it will be glad to furnish booklets upon request. Address is 123 S. Broad Street, Philadelphia 9, Pa.

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2,4-D Information

Pennsylvania Salt Manufacturing Co. has issued a booklet describing the use and action of its 2,4-D weed killer product, "Penco." The leaflet names the weeds susceptible to the action of 2,4-D, describes when and how to spray, and illustrates the manner in which the hormone shuts off the plant's food supply. Precautions in its use are given, warning the user against applying the preparation near crops susceptible to 2,4-D.

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"Fermate" Instructions

A revised issue of a circular on "Fermate" is announced by E. I. duPont de Nemours and Company, Wilmington, manufacturers of the fungicide. The pamphlet describes the product, makes suggestions as to its use in general, and presents a list of fruits on which "Fermate" may be used effectively against diseases attacking them. The fruits include apples, pears, sweet and sour cherries, snap or string beans, celery, cranberries, tomatoes, lettuce, tobacco, greenhouse and ornamental plants.

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Geigy Co. Advertising

Geigy Company of New York has issued a comprehensive brochure depicting the scope of national advertising of its products "Gesarol" and "Neocid." A spread 33 x 17" presents copies of the advertisements themselves, and on another page is a chart showing the states covered, the number of farms, and the cash income of farmers reached by the several publications carrying Geigy consumer advertising.

Also pointed out in the literature is the fact that Geigy is the originator of DDT insecticides.

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Kolker Adds DDT

Kolker Chemical Works has announced the addition of the insecticide DDT to its line of agricultural chemical specialties. The company's line also includes 2,4-D, new selective weed killer. Kolker Chemical Works is located at 80 Lister Avenue, Newark 5, N. J.

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Abstracts in Booklet

In a recent issue of its house magazine, "Brimstone Brevities," Freeport Sulphur Co., New Orleans has published a number of abstracts of articles dealing with agricultural insecticides and fungicides. The issue is dated July, 1946. Address of the Freeport Sulphur Co. is 1804 American Bank Bldg., New Orleans 5.

DDT IN MILK

(*Continued from Page 27*)

concentrated sulfuric acid solution (5 g. per 100 ml.), then with a 1:1 mixture of fuming sulfuric acid (20-30% SO_3) and concentrated sulfuric acid, and finally with another one or two portions of sodium sulfate-sulfuric acid solution. After the chloroform solution has been washed with 5% aqueous sodium bicarbonate, it is evaporated and the residue submitted to the Schechter-Haller colorimetric analysis for DDT.

Although this method was developed independently, similar procedures have been used to determine oil deposits on leaves (*8*) and diphenyl in oranges (*2, 17*). The process is somewhat reminiscent of petroleum refining with sulfuric acid. Even though the procedure is not very rapid, it does permit the detection and estimation of DDT as such, in amounts as low as 1 p.p.m. in milk.

The results of our preliminary analyses show that DDT can occur in milk up to 25 p.p.m., or even higher, depending on the cow's intake of DDT. The results also demonstrate that DDT is concentrated in the butterfat portion of the milk. Butter made from milk containing 25 p.p.m. of DDT ran as high as 532 p.p.m. A sample of fat from a T-bone steak contained as much as 178 p.p.m. of DDT, whereas carefully trimmed lean meat from this steak contained only 4 p.p.m.

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Fertilizer Meeting

The Fall meeting of the National Fertilizer Association is scheduled for November 12 and 13 at the Atlanta Biltmore Hotel, Atlanta, Ga., according to the N.F.A. News which says that further details will be announced at a later date.

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Technical Briefs

DDT from Airplanes

Experiments made in 12 states and 1 Canadian province with DDT in oil solution, sprayed largely by airplane, and some laboratory experiments are described in a recent issue of *Journal of Economic Entomology*. Airplane applications ranged from 0.2-5 pounds of DDT per acre. Insect pests are controlled by 0.1-1 pound per acre. Although much more work must be done before the long-time effects of DDT on wildlife can be evaluated, most of the higher DDT concentrations used caused pronounced mortality of wildlife. Invertebrates such as crayfish and crabs, and cold-blooded vertebrates suffered most, while birds and small mammals were less readily affected. In a single trial, DDT was more toxic in emulsion form than in oil or in suspension. Except for treating small areas, DDT should be used in minimum dosages and only when necessary it was concluded. In treating forest areas, a sanctuary should be left. Applications should be timed to avoid migratory and nesting birds. C. Cottam and E. Higgins. *J. Econ. Entomol.* 39, 44-52 (1946).

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Peach Insect Control

Control of peach insects is discussed in the August, 1946 issue of *American Fruit Grower* by Oliver I. Snapp of the Bureau of Entomology and Plant Quarantine, USDA. He describes various means of combatting the peachtree borer, the plum curculio, the San Jose scale, and the oriental fruit moth in peach-growing states east of the Rocky Mountains.

The peachtree borer, which attacks both young and old trees, is controlled with paradichlorobenzene crystals, ethylene dichloride emulsion, or proylene dichloride emulsion. The author describes the proper proportions of materials and procedure of application, warning that incorrect use may injure trees.

Plum curculio, or peach worm, as it is called by many peach growers, is most serious in the south where it is two-brooded, but is also a major pest in other parts of the country. The adult females injure the fruit by puncturing it for egg laying, and the adults of each sex damage fruit further by puncturing it for feeding. Use of lead arsenate when applied at the right season permits control except at such times when heavy infestations occur and supplemental measures are necessary. The latter include jarring the trees to gather adult curculios, collecting drops to prevent the development of adults from larvae in the fallen peaches, disking under the spread of the trees to destroy pupae in the soil, eliminating places of adult hibernation and post-harvest dusting with lead arsenate.

Control of the San Jose scale is gained by spraying the trees thoroughly with either lime-sulfur or oil during the dormant season. Lubricating-oil emulsions should be used at a strength of 3 per cent of actual oil, the author says, and miscible oil should be used at the strength recommended on manufacturers' label. (Usually from 4 to 6 per cent.) Lime-sulfur should be used in the proportion of 1 part of the concentrate to 7 parts of water.

Interfering seriously with growth and development of young trees, the oriental fruit moth damages both the twigs and the fruit of the peach. Control of this pest has proved difficult through use of insecticides, although recent experiments with DDT indicate that this product may offer some promise of control. The use of parasites has been generally recognized as being valuable in checking the oriental fruit moth.

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Sheep Dip Mixture

Successful trials have been reported in English with a sheep dip concentrate in the of a liquid emulsion, containing 15 per cent of DDT, 34.1 of solvent naphtha, 6.3 of oleic acid, 0.75 of caustic soda, 1.8 of Teepol X, and 42.05 per cent of water.

The concentrate was diluted 1 to 30 with water to give a bath containing 0.5 per cent of DDT. There was no evidence of skin irritation after 30 seconds' immersion of ewes and lambs. Two dippings gave complete protection against normal maggot-fly strike and was toxic to blowfly maggots. *Chem. Trade J.* & *Chem. Engineer* 119, 71 (1946).

•

Dust Drift Injures Crop

Severe damage has been inflicted on peach orchards in some sections of New Jersey because of drifting arsenic and copper dust distributed by airplanes, according to Prof. Arthur J. Farley, fruit specialist for the Agricultural Extension Service of Rutgers University. He indicated that the damage would carry over to next year's crop because the cankered areas on the new growth would either destroy or greatly weaken next year's fruit buds.

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Radio-Active Stimulation?

The much-talked-about account of the Hiroshima atomic bomb explosion which appeared in a recent issue of New Yorker contains a few paragraphs of significance to those interested in botanical phenomena. It tells about an injured young lady who returns to the city's ruins a month after the explosion and finds plant growths greatly stimulated apparently from radiation. To quote the lines:

" . . . Over everything—up through the wreckage of the city, in gutters, along the riverbanks, tangled among tiles and tin roofing, climbing on charred tree trunks—was a blanket of fresh, vivid, lush, optimistic green; the verdancy rose even from the foundations of ruined houses. Weeds already hid the ashes, and wild flowers were in bloom among the city's bones. The bomb had not only left the underground organs of plants intact; it had stimulated them. Everywhere were bluets and Spanish bayonets, goosefoot, morning glories and day lillies, the hairy-fruited bean, purslane and clotbur and sesame and panic grass and feverfew. Especially in a circle at the center, cicle senna grew in extraordinary regeneration, not only standing among the charred remnants of the same plant, but pushing up in new places, among bricks and through cracks in the asphalt. It actually seemed as if a load of sickle-senna seed had been dropped along with the bomb . . ."

Virginia Crops Recover

Although reports made in August indicated a serious infestation of late blight on tomato and potato crops along the Maryland shore, and predictions were made that a large percentage of the crops would be lost, word comes that most fields in that area recovered and that good yields were gathered. A letter from Edward Holland, Jr., of Eastville, Va., about 60 miles south of the Maryland line, indicates that growers in that section suffered no loss from blight. "We have harvested one of the largest and best paying yields on record," he writes. "Fields that were expected to die recovered and made heavy yields of good fruit. Most fields were dusted with neutral coppers but even fields not treated at all recovered and produced big yields of good quality."

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Fruitfly Experiments

In a report of laboratory studies of DDT against the Mexican Fruitfly, C. C. Plummer of the Division of Fruitfly Investigations, USDA, sumarizes the results of his work as follows:

Preliminary tests showed that DDT emulsions containing soybean oil, corn oil, or dibutyl phthalate as solvent were more toxic to adults of the Mexican fruitfly (*Anastrepha ludens* (Loew)) at 25° C. than similar emulsions prepared with fish oil, diethyl phthalate, or acetone. DDT in the first group of emulsions was also more toxic than a tartar emetic-sugar solution.

In tests with dried preparations on glass plates, and in the presence of sugar and cut orange, undiluted technical DDT and 10 per cent DDT-pyrophyllite dust were more toxic than DDT dissolved in alcohol, acetone, soybean oil, or a suspension of DDT in alcohol and water. Undiluted technical DDT in the presence of cut orange was not significantly more toxic than tartar emetic mixed with sugar.

When individual flies were forced to touch deposits of DDT from different formulations 5 times in 5 seconds and subsequently held for mortality records, it was found that 10 per cent DDT-pyrophyllite dust was much more toxic than DDT dissolved in either acetone or alcohol, or a suspension of DDT in alcohol and water. Differences in toxicity between DDT in xylene and "Triton X-100," DDT in soybean oil, and an untreated check were not significant. However, in one small test DDT in soybean oil was shown to be as toxic as 10 per cent DDT-pyrophyllite dust when flies were forced to walk on such preparations for 10 seconds, and DDT that had been prepared with acetone was again shown to be less toxic.

When 20 flies whose probosces had been closed with collodion were exposed for 5 seconds to 10 per cent DT-pyrophyllite dust, 17 of the flies were paralyzed within the first hour and 19 flies within 5 hours.

In a series of tests with pyrophyllite dusts containing from 2 to 10 per cent of DDT, toxicity decreased at concentrations below 8 per cent, although only the difference between 10 per cent and 2 per cent was significant. In another series of tests no significant difference was shown between the average mean length of life of flies exposed to 10 per cent DDT dust and to dusts with 12, 14, 16, 18, and 20 per cent.

No significant difference in the average mean length of life was shown between Mexican fruitflies exposed to undiluted technical DDT and those exposed to 10 per cent of DDT in pyrophyllite, talc, aluminum oxide, walnut-shell flour, diatomaceous earth, or sulfur.

Mangoes were dipped in DDT emulsions containing corn oil and fish oil, but the results were not promising. Dusting with undiluted technical DDT and 10 per cent of DDT in pyrophyllite protected other mangoes to a marked degree, and the 5 per cent DDT-pyrophyllite was a little less effective.

•

Storage Hazards Reduced

Cornell University researchers have found that use of methyl ester of alpha napthalene acetic acid retards sprout growth of potatoes and root and top growth of beets, carrots, turnips, and rutabagas during the storage period. It also permits storage at temperature high enough to prevent the formation of reducing sugars that lower the cooking quality of potatoes.

•

Peanut Seed Bulletin

"Treat Seed Peanuts For Profit" is the title of a new bulletin, No. 382, issued by Virginia Agricultural Experiment Station, Blacksburg, Va., which discussed the use of various chemical seed disinfectants to protect seed peanuts from soil borne bacteria and fungi. Conclusions reached are based on a 7-year investigation, extending from 1939 through 1945.

Four commercial disinfectants are recommended for use in the following order of preference: "Arasan," "2 per cent Ceresan," "yellow cuprocide," Spergon." Excellent results were obtained with two other materials, designated as U. S. R. 604 and Dow, 9, the bulletin states, but since they were tested for only one season final recommendation on them was reserved, pending further tests.

The findings from the study, it is pointed out, open the way for larger use of machine-shelled seed peanuts, formerly avoided by peanut planters, because of injury to the seed by the machine, which resulted in infected seed, poor stands and heavy losses. Machine shelling, it is figured, will save $200,000 a year in labor costs and another $150,000, estimated as the value of peanuts consumed by workers during the process of hand shelling. Cost of the seed treating chemicals, it is pointed out, would be insignificant in comparison, while larger profits would result from the increased yields, as the experiments have demonstrated.

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Co-op Phosphate Rock

Washington State Council of Farmer Cooperatives, Seattle, Wash., is studying a proposal for construction of a cooperatively-owned plant to process phosphate rock for fertilizer. If consummated, the new project would be located in southern Idaho, where large deposits of phosphate rock are found, about 80 per cent of it being on government-owned lands.

ELECTROSTATICS

(*Continued from Page* 35)

were mixed, then the charge was reduced because of a neutralizing effect; with suitable proportions of the two materials, the charges of both were completely neutralized.[5] By changing the proportions of two materials of unlike charging tendency, the sign of charge generated by the mixture could be varied from (—) to (+) or (+) to (—). However, as exceptions, peculiarities developed with albite, almandite, hornblende, and rhodenite. These materials singly all became positively charged, but when combined with "Pyrax" they actually augmented its (—) charge. Likewise, when mixed with "AA Mica" they reduced the (+) charge of "AA Mica."

Mineral samples of a same general composition consistently produced the same sign of charge even though the proportions of the different components in different samples varied as much as 20 per cent or more. For example "Pyrax" has three component minerals, pyrophyllite, quartz, and mica. The mica content varies only to a slight degree, varying from 10 to 15 per cent but the pyrophyllite may range from 30 to 90 per cent and the quartz from 10 to 60 per cent, yet the charge in the dust cloud is always (—). While the charge per gram for various samples varied considerably, it was found that any particular sample gave about the same average charge under similar conditions in tests extending over a period of three years.

Samples of different types of talc showed a wide variation in the development of charge, some samples developing (—) charges, and others (+), possibly owing to widely varying crystal structure in different members of the talc group, and also to content of mineral impurities, especially chlorites. Samples of steatite talc (soapstone) were quite variable, some samples produced (—) charges while the charge produced by the sample reported here was distinctly (+) as shown by the data obtained when mixed in different proportions with Wisconsin talc which is distinctly negative (table 1). A sample of serpentine (magnesium analogue of kaolinite, sometimes included with the commercial talcs) was weakly (+).

A sample of tremolite talc (fibrous) did not produce a charge when tested alone; in equal portions with "Pyrax" of "AA Mica" this material completely neutralized the respective (—) or (+) materials, table 1. Smithsonite (zinc carbonate) was shown to be strongly (+) because only one part in fifty greatly reduced the charge of "Pyrax" and the (+)

[5] O. C. Ralston, Principal Chemical Engineer, U.S. Bureau of Mines, suggests a possible explanation of how additive effect of two minerals taking the same sign of charge is greater than the potential of either. "Under the conditions of operation of the nozzle one mineral can be charged to potential P_1 the other to P_2 by impact and separation from the nozzle wall. The effects average up to an arithmetic summation. However, if both particles are dielectrics they also impact each other in a turbulent stream of air and one will be charged + and the other —. Assuming that the two minerals each took on — from impact with the nozzle walls, the + charged particles are a minority in the mixture and quickly meet and neutralize — particles of both minerals. These neutrals have new opportunities to impact the wall and become — again. [6]— charged particles of each mineral on impact and may part with one higher in negative potential and the other much lower (equivalent to becoming + to the average atmosphere in the nozzle). By whatever mechanism, the additional potential is that added by impact of the two minerals against each other."

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charge was maintained when equal parts of this material were combined with "AA Mica." Sulfur which generates no charge markedly depressed the (—) charge of "Pyrax." Manganite, sulfur, and barium carbonate all had particles of very small size.

Repeated tests showed that when some samples of material giving high charges were ground and reground, the charge potential decreased as the particle size was reduced by each succeeding grinding. When all materials were ground to clay fineness, the charges were comparatively low and in some cases reduced to zero. Where tests were made with different particle sizes as obtained by screening it was found, even when a relatively limited size range is considered, that particle size greatly affected the magnitude (but not the sign) of the dust charge, table 2. It will be noted that some materials gave increased charges while other materials gave markedly decreased charges as the particle size was reduced. These conditions may offer a partial explanation of the variable control obtained with insecticidal dusts compounded with the same minerals. It is interesting to note that in a similar relationship the coercive force of magnetic powders also increases with decrease of particle size.***

*** Gottschak, V. H. The Coercive Force of Magnetic Powders. Physics 6, 127-139, 1935.

Factors in Development

THE generation of the electrostatic charge of the dusts probably lies in the friction and impact between dust particles, as shown by the development of electrical charges in dust storms. However, it may arise in part also by striking of the dust particles against the walls of a dust blower, because the dust blower always has a charge opposite to that produced in the dust cloud as shown in figure 2.

Particle size factor. From the foregoing data there appears to be a particle size factor which requires for generation of a charge, whether (—) or (+), that the particle size (extent of frictional sweep across any one crystal) be commensurate with the physical conditions of the apparatus (size, air velocity, etc.). Little if any charge was registered when the particle size became relatively small[6] (under 2 microns). Using some iron ores or pure silicon crystals and starting with a sample of coarse powder (60 mesh), the charge usually increases with further grinding, limonite, goethite, and quartz, table 3). However, after a maximum charge is reached with these materials, the charge declines with further grinding (illustrated with quartz, table 2).

6 With larger apparatus, greater velocities, etc., a different size range of particles might be found to be electrostatically active and a different order of magnitude of voltages be found (active volcanic cone as an extreme example).

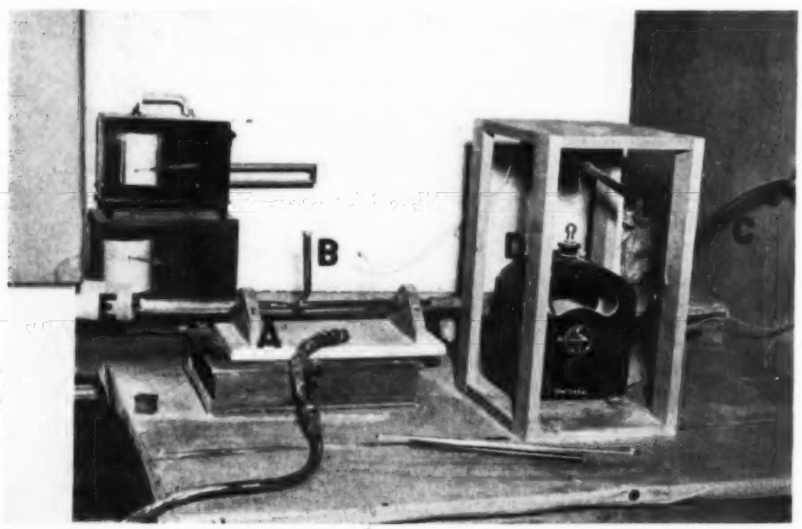


Fig. 2. Apparatus for recording electrostatic charge effects of finely ground substances. A.—Dust blower tube with indentations. B.—Dust hopper. C.—Air source. D.—Electrostatic voltmeter. E.—Dust collecting chamber. F.—Tube fitted over hopper in cleansing operation by back pressure.

Other minerals, brucite and steatite, showed high charges with coarse powder and declined immediately on grinding to smaller particle size, probably owing to the presence of an excessive number of particles which were much smaller than the screen mesh sizes indicated. These smaller particles may become distributed over the surfaces of the larger particles and thus interfere with the normal frictional sweep and charge developed by the larger particles (mechanical buffer effect). This mechanical buffer effect was produced even when the excessively fine particles are composed of materials which in themselves seemed to be electrostatically rather inactive, as noted with manganite, sulfur, and barium carbonate (Table 1).

Origin of Charges

THE materials found to give rise to negative electrostatic charges were predominantly acid in character. It was noted that the silicate minerals which gave marked negative charges (quartz, talc, and pyrophyllite) shared the common crystal lattice property of exposing silica tetrahedra at surfaces as a result of cleavage (in the latter two minerals by fracture along the basal 001 planes of perfect cleavage). This gives rise to exposure of oxygen ions (negative) at the surfaces of these materials, while the silicon ions (positive) are enclosed within the tetrahedral units. The presence of negative ions at surfaces (negative dipolar effect) does not, however, explain the observed negative electrostatic charge observed with these minerals; an actual accumulation of excess electrons is necessary to produce the negative electrostatic charge.

The most tenable postulate as to the factor which gives rise to the (—) charge is in the presence of H+ ions at surfaces of these acidic materials. A few scattered protons (H+) are swept off the acid surfaces during charge development by frictional contact, thus giving rise to a negative residual charge on these materials. This explanation extends to the various types of negative materials in-

(*Turn to Page* 61)

Comments....

By Dr. Alvin J. Cox

This column by Dr. Cox will appear from time to time as a feature of AGRICULTURAL CHEMICALS. Dr. Cox formerly was successively Physical Chemist, Chief Chemist, Assistant Director, and Director of the Bureau of Science, Government of the Philippines. He was appointed Chief of the Bureau of Chemistry, California State Dept. of Agriculture in 1932 and retired in 1945.

EVERY one is familiar with the almost complete devastation caused by the war in European countries, but the degree of destruction which has been visited on the Orient is less well known. I happen to have personal acquaintance with one very tragic instance in the Philippine Islands. When I was Director of the Bureau of Science, Government of the Philippine Islands a number of years ago, we secured a fireproof building with steel shelves for the scientific library. Those in charge at the time of the Japanese invasion, thinking that this building would surely be the safest place for all publications, called in all outstanding loans of books and other printed materials. But the Japanese had no consideration for this famous collection of 30,000 volumes, many of which are now quite unobtainable, and burned it all to the ground. Not one book was saved.

In China the destruction of colleges and scientific institutions has been spotty. Most of them lost very heavily in either buildings or equipment or both. The unfavorable rate of exchange caused by the current inflation of Chinese currency has brought about a situation highly unfavorable for the purchase of needed equipment, publications, and other scientific materials from the United States. Conversely, every United States dollar contributed to Chinese aid has exceptional purchasing power in terms of Chinese study and materials.

It is of course impossible to do anything in economic entomology or in any other branch of applied science without equipment. The people of the Orient need our help desperately in getting this equipment. Agriculture in China even today is carried on at the very lowest economic level and under the most primitive methods. The Philippine Islands were progressing well before the war, but an abortive program, started during the Japanese occupation, uprooting sugarcane fields and compelling the natives to grow cotton for Japanese factories has set them back many years. Throughout the Orient there is, in particular, very little mechanization and comparatively small use of chemicals in agriculture. Except for derivatives from a few native plants, insecticides are virtually unknown. For all these reasons, the Orient offers a tremendous field for chemical research and development, and potentially a great future market for American supplies.

If American agricultural chemicals are to be used in China, for example, they must first be tested on the ground there. Insecticides and other economic poisons must be experimented with against the various local pests in order that proper recommendations for effective use of these products may be drawn up. There are many and great differences between the Orient and the United States not only in the species of pests found but also in the crops grown and the weather conditions, especially humidity, under which they grow.

It would seem logical, and may even be said to be imperative, for the re-establishment of the Philippine and Chinese foreign markets, that firms in this country which hope to do business there should provide research fellowships in foreign universities and scientific institutions. In this way the local agricultural conditions can best be studied. As a part of this program, insecticides and equipment for spraying, dusting, and other purposes necessary to a thorough study might well be supplied also. I do not know of anything more encouraging to the people who are trying to reconstruct burned-out institutions and libraries than to receive from us whatever cash or apparatus or equipment or materials we can spare.

Such action on the part of American manufacturers will aid in a movement now taking shape in several organizations in this country to help in giving the Orientals the trained men and materials they need in order that they may help themselves. It will also eventually stimulate a demand for American products if Oriental farmers can be taught to see the economic advantages of their use. This is an opportunity for manufacturers, steamship companies, airlines and anyone else anticipating commerce in the East to combine philanthropy with good business.

Dr. William B. Pettus, President, California College in China (College of Chinese Studies), 1700 Spruce Street, Berkeley 9, California, who has just returned from China, states that this appeal for aid is most timely. The vice president of the University and Dean of Agriculture of the University of California is now in China with others, seeking to aid in the solution of China's agricultural

(Turn to Page 63)

New Shell Agricultural Plant Dedicated at Modesto, Calif.

A NEW half-million-dollar agricultural laboratory and experimental farm located near Modesto, California, was dedicated September 11 by Shell Oil Company, Inc. Purpose of this new project, according to Dr. Roy Hansberry, director, is to develop new ideas, to provide a proving ground for natural and synthetic products derived from petroleum, and to act as a scientific clearing house where farm problems may be presented and solved.

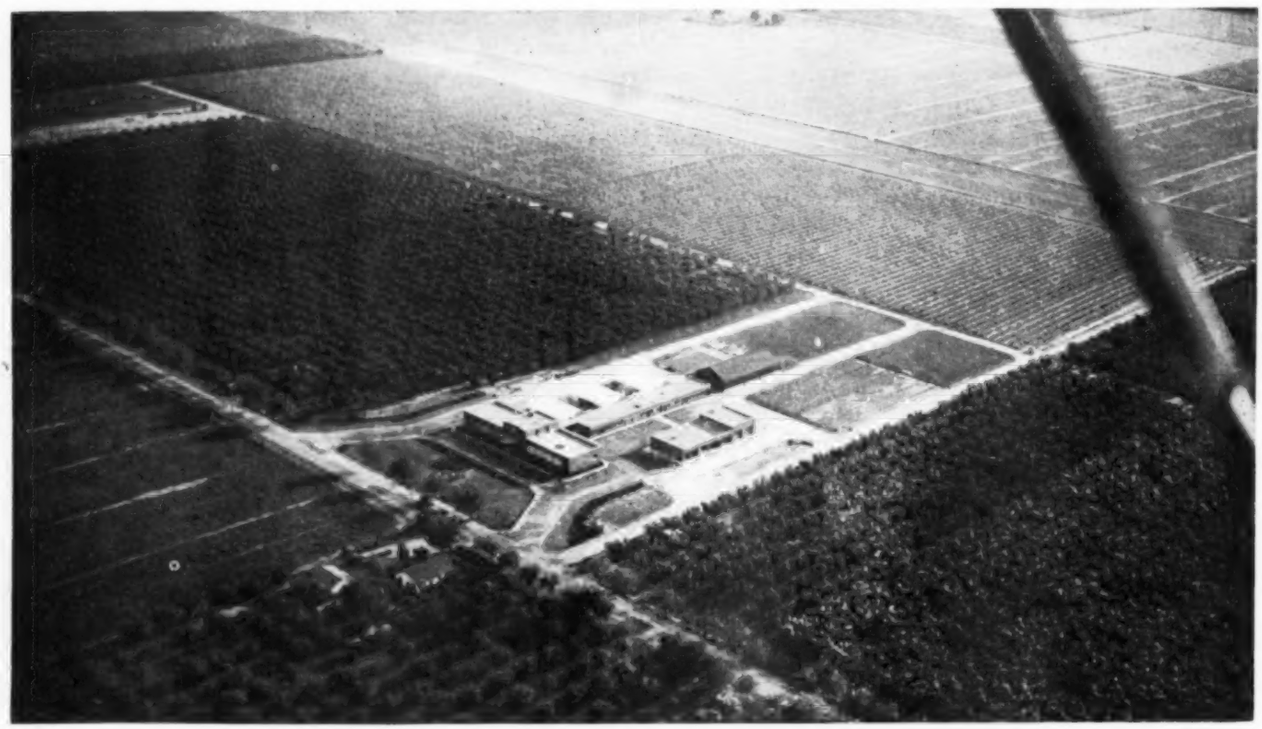
The dedication ceremonies were attended by some 500 persons, including W. C. Jacobsen of the California State Department of Agriculture, Dean K. A. Ryerson of the University of California, Davis; Dr. A. M. Boyce of the U. of California Department of Entomology; Gerald Thorne of the U.S.D.A. Bureau of Plant Industry, Salt Lake City; Hon. Carl W. Shannon, Mayor of Modesto, Calif.; Dr. Dwight C. Baker, president of Modesto Junior College, and Dr. Alvin J. Cox, member of the editorial advisory board of *Agricultural Chemicals*. The guests were served a barbecue luncheon, following which a tour was made of the laboratory and grounds.

The new laboratory is the center of the company's agricultural research in the United States, and the only one of similar size and scope in the west, according to the company. The main building is surrounded by a 142-acre farm which produces a variety of crops needed for field testing on a commercial scale. The outlay includes in addition to the main building which houses research laboratories and administrative offices, three greenhouses with a connecting head house, a large lath house, and a service building for garages and shops. A laboratory staff of 30 persons has been assembled from various parts of the country, chosen on the basis of specialized training and experience in many phases of agricultural science.

Dr. Hansberry, in commenting on the new project, told something of the aims and purposes of the project, explaining that the farmer needs scientific answers to his problems of pest control, and that the establishment of such industrial research centers will help solve many of these problems. Selection of a location near Modesto was made because of suitability of the soil and climate for growing a wide range of crops needed in the research program. The projected planting will provide 100 acres of trees and vines of all commercial types and 30 acres of truck crops. The remaining 12 acres are utilized by the buildings and improved roads.

Future plans for the project include the erection of ranch houses, implement storage and warehouse facilities, and a fruit handling building. These are expected to be started as soon as materials are available, according to Dr. Hansberry. Fifty acres of land have been cleared for the project.

Below: Air view of the new laboratory buildings and part of surrounding 142-acre experimental farm recently opened by Shell Petroleum Corp., near Modesto, California. More than a half-million dollars has been invested in this project. (Photo courtesy Shell Oil Corp.)



INDUSTRY NEWS

AIF Membership Head

J. G. Collins, sales manager for agricultural chemicals of the Naugatuck Chemical Division of U. S. Rubber Co. has been named chairman of the Membership and Information Committee of the Agricultural Insecticide and Fungicide Association. Mr. Collins succeeds Ernest Hart of Niagara Sprayer & Chemical Division, Food Machinery Corp., Middleport, N. Y., who resigned recently because of the pressure of other business.

Mr. Collins joined Naugatuck Division in 1934, and at first engaged in research and development work on reclaimed rubber and in developing outlets for such newly-developed materials. Later when the company entered the agricultural chemical field, Mr. Collins was named to coordinate the evaluation of the various chemicals and develop markets for them. This assignment brought about many contacts with agricultural colleges and experiment stations, in addition to the usual distribution outlets.

Later, when the Naugatuck Division was well established in the agricultural chemical field, Mr. Collins was appointed sales manager.

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Dunbar Joins duPont

James H. Dunbar, Jr. has been appointed assistant sales manager of the Semesan Division of E. I. duPont de Nemours and Co., it was recently announced by the company. Mr. Dunbar had been district sales manager in the New York office of the Remington Arms Company since his return from military service late last year. Before the war he had represented Remington in the east and midwest. He is a graduate of Yale University.

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Major Forms Business

W. E. Major, formerly west coast manager for General Chemical Company, and for the past nearly four years engaged in the establishment of a Chemical Division for the Union Oil Company of California, has returned to private business under the firm name of W. E. Major Industries, 1151 South Broadway, Los Angeles 15. Mr. Major will act as manufacturers' agent and broker for a number of western concerns.

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Subsidy for Fertilizer

According to reports of the U. S. Department of Commerce, Mexico has granted a subsidy for the importation of a total not exceeding 500 metric tons of copper oxychloride from the United States. Under the terms of this subsidy, cost of the material is limited to $354.94 per ton, and the subsidy payment to $71 per ton. Also specified is the time limit: all importations must be made by December 31, 1946.

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Fertilizer Booklet

Among publications listed by the U.S. Government as available is a 56 page illustrated booklet on Fertilizers. It describes prewar world production and consumption of plant foods and gives information relating to prewar world supply, plant-food statistics by geographic divisions and units, such as Africa, Asia, Europe, North America, etc. Price is 20c. Catalog No. A 1.38:593. Write Superintendent of Documents, Government Printing Office, Washington 25, D. C.

Dr. Peterson to Baker Co.

Dr. Willard D. Peterson has been appointed Associate Director of the Organic Research Division of the J. T. Baker Chemical Company, Phillipsburg, N. J., according to division director, Dr. Joseph R. Stevens. Dr. Peterson was formerly with General Aniline and Film Corporation where he was engaged in administrative work in research and development. He also worked for a number of years in the Synthetic Organic Chemicals Department of Eastman Kodak Co. He holds degrees from Iowa State College and Harvard University.

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G. T. Collins Promoted

Appointment of George T. Collins as manager of the market research department of Pennsylvania Salt Manufacturing Co. was recently announced by the company. Mr. Collins was formerly a chemical engineer in the department, and at the time of his recent promotion was assistant manager of market research. He has been with the company since 1943.

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Dusting Casualty

Harold Northrup, 21, of Galesburg, Ill., was killed Aug. 15 when the airplane with which he was dusting fields near West Helena, Ark., hit a power line, crashed and burned.

Decontrol All Insecticides Except Rotenone Products

AGRICULTURAL insecticides, fungicides, rodenticides, weed killers and related products except rotenone and rotenone products were decontrolled by OPA as of October 1. Amendment 58 to Supplementary Order 132 calls for the removal of price controls for agricultural insecticides, deodorants, disinfectants, fungicides, repellents, rodenticides, seed treating compounds and weed killers "when packaged and branded as such and consisting of a mixture of two or more chemical components or any of the following individual components: calcium arsenate, copper arsenate, copper sulphate monohydrated, copper sulphate tribasic, lead arsenate, London purple, nicotine sulphate, Paris green, pyrethrum, sodium arsenate, sodium cyanide, zinc arsenite, zinc chloride and zinc sulphate. Any other individual chemical component when sold separately, is not exempt, even when sold for agricultural purposes."

The exception of rotenone products is specific. Some confusion existed in the industry, however, when the order was issued regarding some chemical products not mentioned specifically in the order. This had to do with the status of straight sulfur, though sulfur mixtures were believed included in "a mixture of two or more chemical components." Uncertainty regarding 2,4-D and benzene hexachloride was also noted.

The OPA statement of the considerations involved in issuance of this amendment follows:

"The accompanying amendment to Supplementary Order No. 132 exempts 16 items (four of them food) from price control. Such action is taken under the policy expressed in OES Directive 68 and the authority given the Administrator in sections 1A (d) (1) and 1A (f) of the Price Control Extension Act of 1946. Section 1A(d) (1) directs the Administrator to remove price controls from all non-agricultural commodities not found to be important in relation to business costs or living costs as rapidly as is consistent with the avoidance of a cumulative and dangerous unstabilizing effect, but in any event such controls shall be removed prior to December 31, 1946. Section 1A (f) permits the Administrator further authority to remove controls which, according to his judgment would be consistent with the intent of Congress.

Among the nonfood items exempted from price control by this amendment are agricultural insecticides, fungicides and related products. The Administrator finds that these items are insignificant in relation to the total cost of any controlled agricultural commodity and are eligible for exemption under section 1A (d) (1) of the act. In addition, their supply is generally in balance with demand and they are equally eligible for decontrol under section 1A (d) (2). The marketing season for 1946 is now past and it is believed that any possible local inequities will be adjusted before the beginning of 1947. Controls are being retained on insecticides containing rotenone or rotenone products because this active ingredient is entirely an imported item which gives every indication of remaining in short supply for at least another year. DDT products, household insecticides and related items were removed from price control by previous amendments to this supplementary order."

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A fixed neutral insoluble micronized* tribasic copper sulphate containing 53% metallic copper for dusting or spraying. No lime required—extremely fine particle size, 2-5 microns.

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Sherwin-Williams Company in Demonstration of 2,4-D

A PREVIEW of two new films, "Good-Bye Weeds" and "Doomsday for Pests," was presented September 12 at the Monte Carlo Casino, New York, by the Sherwin-Williams Company. The movies, in sound and color, were produced by Jerry Fairbanks, Inc. Representatives of the press were present at the showing.

In making the picture "Good-Bye Weeds," delayed-action photography was used to illustrate graphically how the 2,4-D product "Weed-No-More" causes weeds to wither and die. Movie film was exposed at the rate of one frame every five minutes for a period of three weeks, so that when the picture is projected, the observer can witness within a few minutes the process of withering which has required several weeks of actual time.

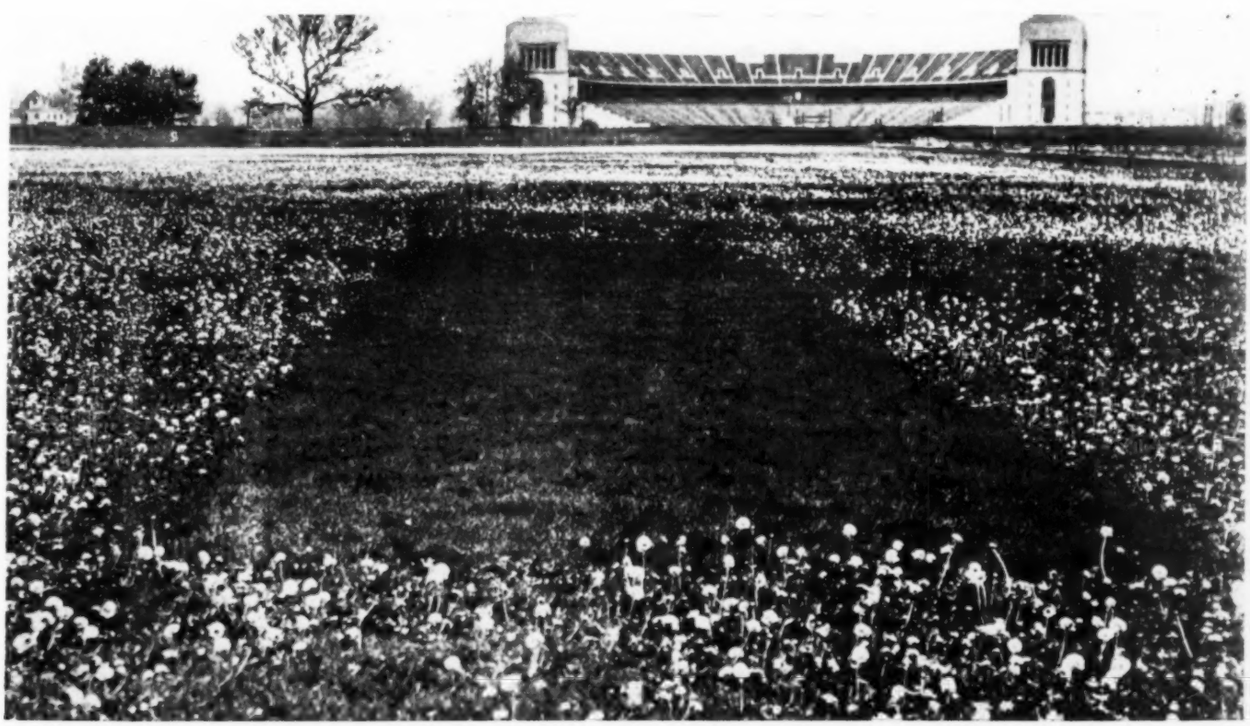
The insecticide film pictures the effect of DDT on various types of insects, and describes two Sherwin-Williams DDT products, one a 10 per cent powder, and the other a 6 per cent liquid coating.

Applications for use of the two pictures will be handled through the Sherwin-Williams Company, Cleveland, and its 350 branches as well as its six affiliated companies. The latter include Acme White Lead and Color Works, Detroit; W. W. Lawrence Co., Pittsburgh; The Lowe Brothers Co., Dayton, Ohio; John Lucas & Co., Philadelphia; The Martin Senour Company, Chicago, and the Rogers Paint Products Co., Detroit.

Arthur W. Steudel, president of the company informed the group of the firm's development of a new line of non-paint chemical products and the formation of a new marketing organization to handle distribution. The latter will be built around the salesmen of seven companies in the firm's sales and production group, he said, and this setup is to be supplemented by additional salesmen.

He explained how war-time research had made possible many thoroughly-tested chemical products, and the manner in which DDT has been applied to agricultural pest problems with outstanding success. He also told of the wide distribution job of Sherwin-Williams 2,4-D weed killer product which, although launched only last spring, has enjoyed heavy sales and a brisk demand.

Dr. N. E. Van Stone, vice president and research director of Sherwin-Williams spoke to the assembly about weed killers, stating that 2,4-D is usually thought of as a treatment for turf areas, parks, cemeteries and golf courses where broadleaf weeds are eliminated. But the greatest potential use of 2,4-D is on the farm, he said. Here 2,4-D can be recommended "for the control of weeds in growing crops such as rice, sugar cane, wheat, oats, barley and even corn, since all of these crops are members of the grass family and are therefore resistant to 2,4-D." The most economical application is by airplane which can dust or spray when the plants are small, thus killing weeds and making the



The section of lawn in the central foreground was sprayed last fall with "Weed-No-More," butyl ester type of 2,4-D weed killer produced by Sherwin- Williams Co. Photo was taken in the spring, and shows how sprayed section is entirely free of weeds. 2,4-D kills dandelions, ragweed thistle, poison ivy, plantain and many other broad-leaf weeds; agricultural pests.

crop more healthy with a greatly increased yield.

Elimination of scrub oak and other undesirable woody plants from potential pasture land was forecast by Mr. Van Stone. He cited as an example, the state of Oklahoma which has five million acres of scrub oak on land which otherwise could support one and a half million beef cattle. Mechanical elimination has proved impractical, he indicated.

Mr. Van Stone also mentioned the future development of a new chemical which acts just the opposite of 2,4-D, in that it is more toxic to narrow leaf plants than to broad leaf plants. "This," he stated, "may make possible the elimination of such serious weeds as Johnson grass in the south, and other weedy grasses which reduce the value of land."

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David C. Walden Dies

David C. Walden, 41, for the past 19 years a member of the Connecticut Agricultural Experiment Station at New Haven, died September 13 at his home in Hamden, Conn. Mr. Walden was a member of the Association of Official Agricultural Chemists of North America and of the New England Association of Food and Drug Officials. He was the son of the late B. H. Walden, an entomologist at the Connecticut station. Surviving are his widow, a son and a daughter.

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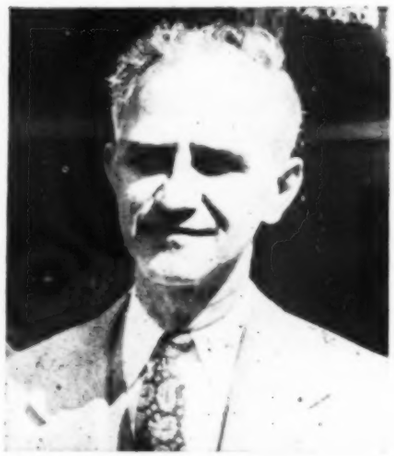
New Montrose Plant

Plans for expansion on the West Coast have recently been announced by Montrose Chemical Company, Newark, N. J. The new affiliate will be known as the Montrose Chemical Corporation of California, with its plant at Los Angeles. Entire capacity of the plant will be devoted to the manufacture of technical DDT for use by manufacturers of agricultural and livestock insecticides.

Decision to establish such a branch followed a recent survey by the company of the Rocky Mountain and West Coast areas which indicated a widespread use of DDT insecticides in western agriculture. The new plant is expected to be in quantity production on DDT by early spring of 1947, according to P. Rothberg, president.

Hedgepeth Leaves Salt Co.



L. L. Hedgepeth

L. L. Hedgepeth, technical assistant to the vice president of Pennsylvania Salt Manufacturing Co. has accepted the position of secretary of the Virginia Water Control Board, it was recently announced. Mr. Hedgepeth, who has been with Pennsylvania Salt Manufacturing Company for the past 17 years, has become widely recognized as a specialist in solving water pollution problems. Since 1929 he has been responsible for the company's technical work in water purification, sewage disposal and stream pollution abatement.

Mr. Hedgepeth is a member of 15 technical committees in the realms of public health and industry, including the Legislative Committee chairmanship of the Agricultural Insecticide and Fungicide Association. For the American Water Works Association he has aided in the preparation of chemical safety standards. This association in 1943 conferred upon him an award for distinguished service in water supply fields. Mr. Hedgepeth is a graduate of North Carolina State College of Agriculture.

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Powell Sales Meeting

New products soon to be introduced by John Powell & Company were announced at the Company's two-day sales meeting held in New York September 18 and 19. Among the products soon to appear are Benzene Hexachloride—BHC—a new insecticide for control of cotton insects, grasshoppers, locusts and aphids; and 2,4-D weed killer in four different formulations. The Company also told of its research work in the field of rodenticides, demonstrating the product "Antu" on laboratory rats. Much work has been done on aerosol formulations during the past year, it was reported, and also in the use of "Sesamin," a synergist which increases the active principles of pyrethrum. The use of this synergist in aerosol formulas containing pyrethrum extract and DDT has been demonstrated to increase rapidity of kill on roaches, according to W. J. Haude, company sales manager.

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New Kentucky Plants

Southern States Cooperative has announced from its Richmond, Va., headquarters that Bowling Green and Winchester, Ky., have been selected as the sites for the two new fertilizer manufacturing plants planned for the service of Kentucky farmers. Identical in design, each will be 100 x 300 ft. in size, of steel construction with metal roof and siding and have a capacity for production of 12,000 to 15,000 tons of mixed fertilizer annually. In addition, facilities will be installed for production of superphosphate. Estimated cost, exclusive of machinery, will run between $150,000 and $200,000 for each plant. Land has been purchased and construction will start later.

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Co-op Volume Increases

Insecticides with a wholesale value of $3,735,900 were handled by eighteen of the major farm cooperative purchasing associations for the fiscal year 1944, according to a study released by the Farm Credit Administration. This was an increase of 3.6 per cent over the $3,605,980 insecticide business done in 1943. Volume sales by individual organizations ranged from $1,122,901 handled by Fruit Growers Supply Co., Los Angeles, down to $8,735 handled by Central Cooperative Wholesale, Superior, Wis. Not all of the eighteen co-ops covered by the study deal in insecticides for their members, the report indicated. Fertilizer business handled by the same eighteen co-ops approximated $24,000,000, according to the report.

Chicago Chem. Exposition

Among the exhibitors at the Fourth National Chemical Exposition held in Chicago last month, were a number of firms displaying chemicals for agriculture. Included were the Hercules Powder Company, Wilmington, which presented "Thanite" and DDT; Reichhold Chemicals, Inc., Detroit, showed insect repellents; Dow Chemical Co., Midland, Mich. directed attention to its new "2,4-Dow" weed killer, methyl bromide and chloropictrin for agricultural uses; Velsicol Corp. of Chicago presented its insecticide, "1068", and Carbide and Carbon Chemicals Corp. had on display its new "6-12" insect repellent.

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Mills to United Co-op.

United Co-Operatives, Inc., of Alliance, Ohio, announces the appointment of R. Wayne Mills to the new position of manager of its insecticide department. Mr. Mills was formerly manager of the insecticide and fungicide department of Farm Bureau Services, Lansing, Michigan. He takes the place recently vacated by J. L. Batty, now head produce marketer at Rochester, N. Y. for G.L.F. Marketing Service.

Mr. Mills is a native of Lansing, Michigan, and began work with the Michigan State Farm Bureau in 1925. He has risen through the ranks, gaining knowledge of many pest control problems in the process. During the war he was a Lieutenant (jg) in the U.S. Naval Reserve, and was discharged early this year as a Lieutenant, Senior Grade.

Knipling Accepts New U.S.D.A. Position

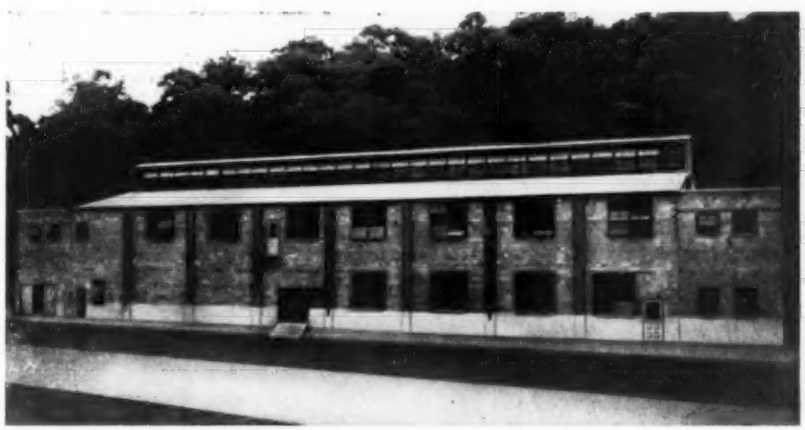
Emory C. Cushing, (left) who recently resigned as head of the Division of Insects Affecting Man and Animals, Bureau of Entomology and Plant Quarantine, U.S.D.A., extends best wishes to his successor, Edward F. Knipling, who assumed the post on September 15.

Edward F. Knipling has been appointed head of the Division of Insects Affecting Man and Animals, Bureau of Entomology and Plant Quarantine, U.S.D.A. He succeeds Emory C. Cushing who resigned in September after having been with the Division since 1928. Mr. Cushing has returned to his Texas ranch, near San Antonio.

Mr. Knipling, connected with the Bureau since 1931, has had wide experience in the field of medical and veterinary entomology. As senior entomologist in charge of the Orlando Laboratory during the war years, he helped develop methods for control of insects which carry diseases or annoy troops. He and his Bureau associates developed or adapted nearly all insecticides, repellents, and methods for their application used by the armed forces during the late war. In recognition for his work, the U.S. Typhus Commission Medal was awarded him last spring.

The new division head is a native of Port Lavaca, Texas. He holds degrees from both Texas A. & M., and Iowa State College.

J. T. Baker Co. Opens New Laboratory



Another unit for the Organic Chemical division of J. T. Baker Chemical Co. has been opened recently at Phillipsburg, N. J. This modern, well-equipped building (shown above) will be used for the manufacture of a new group of organic chemicals now in the pilot-plant stage, according to Ralph A. Clark, vice-president. New products will be in addition to DDT, 2,4-D and CTAB also produced at Phillipsburg.

"Borrowed" Fertilizer Materials Must be Returned, Says Lodge

SPEAKING at a session of the division of fertilizer chemistry of the American Chemical Society in Chicago last month, F. S. Lodge of the National Fertilizer Association warned that any delay next spring in the return of nitrogen-bearing fertilizer materials now being borrowed by the Government from our domestic supply and shipped abroad to occupied countries may seriously curtail fertilizer supplies for spring planted crops in the United States.

Outlining the prospects for fertilizer supplies in the 1946-47 crop planting year, he explained that the War Department has been authorized to ship to occupied countries two-thirds of the ammonium nitrate to be available from all sources during August and September, with a like amount to be returned from the production of the reactivated Government plants by the end of April. It was emphasized that April shipment is late for materials to be used in manufacturing fertilizer for spring planted crops.

About 66,000 tons of ammonium nitrate were set aside for shipment to occupied countries in August and September, he said. Further shipments requested for October and November have not yet been authorized. Although farmers in the United States are expected to get a little more fertilizer than was used in the year ended last June 30, estimates for nitrogen, phosphoric acid and potash supplies are further predicated on a year of production free from strikes and car shortages due to transportation embargoes. On the other hand, he pointed out, if for any reason export by the Government should be discontinued, a surplus of materials would quickly develop in the United States.

Five of the twenty Government nitrogen plants have been taken over by private enterprise or are in the final stages of such negotiations, he said. The others are being reactivated as rapidly as possible by the War Department to furnish nitrogen for export so as not to encroach upon commercially produced nitrogen materials for United States use. It may be some months before all of these plants are in production.

While it is expected that about 15,000 tons more nitrogen than 665,000 tons used in the 1945-46 fertilizer year will be available in 1946-47 for the mainland, Hawaii and Puerto Rico, most of the increase will go to the islands for sugar production. Most abundant source of supply will be nitrogen in solution. However, there is a limit to the amount that can be used safely with any amount of superphosphate, Mr. Lodge said.

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Kenya Group Visits U. S.

Headed by R. E. Norton, Commissioner for East Africa in London, a delegation from the Pyrethrum Board of Kenya is visiting in the United States for important discussions with American processors and importers. Members of the delegation include W. F. B. McLellan, chairman of the Pyrethrum Board of Kenya, R. H. O. Lopdell, Assistant Manager of the Kenya Farmers' Association, and Drs. Furlong and Coomber, scientists. During their stay in the United States, the Delegation is making its headquarters at the offices of the Greene Trading Co., Inc., 70 Pine Street, New York 5.

"Ted" Riedeberg

Announcement was recently made by Westvaco Chlorine Products Corp., New York, of the appointment of Theodore Riedeberg as sales manager of its agricultural chemicals division. Mr. Riedeburg was formerly with Dow Chemical Co., Midland, Michigan.

A Case of Mistaken Identity

Dr. Stanley B. Freeborn

Allen B. Lemmon

Californians are said to be much alike under the skin, but unfortunately, they don't always look alike on the surface. Thus a considerable amount of kidding was directed toward Agricultural Chemicals at the AIF Association meeting last month when it was discovered that the photograph of Dr. Stanley B. Freeborn was incorrectly identified as Allen B. Lemmon in the September issue. Both parties involved in the case of mistaken identity have received our sincere apologies.

Dr. Freeborn, incidentally, is with the California Experimental Station, University of California, Berkley. Mr. Lemmon is Chief, Bureau of Chemistry, State of California, Department of Agriculture.

Raw Material Markets . . .

SINCE the heaviest demand for agricultural insecticides has relaxed, it is easier now for the trade to take stock of itself and determine a fairly accurate picture of the over-all situation. Inventories of copper sulfate and rotenone are improved, and distribution of coal-tar chemicals is better although stocks remain tight. Due to heavy demand from the cotton states and restricted production during the first half of the year, calcium arsenate is still scarce. As for DDT, a backlog of orders is expected to absorb the total output for the remainder of the year.

Fertilizers have been in abnormal demand for the off-season, according to reports, but a shortage of box cars has caused some delay in shipments. Higher ceiling prices on retail prices for fertilizers is a reflection of increased wholesale prices granted by OPA late in July.

It is interesting to note that imports of pyrethrum during June came largely from the Belgian Congo rather than from British East Africa, usually the larger supplier. All demands for pyrethrum are being met, and the product is reported to be in good supply. Total receipts for the first six months of the year were 12,491,000 pounds; an increase of 20 per cent over the same period of 1945. Total imports from Belgian Congo for the first six months of 1946 amounted to 3,010,000 pounds, a significant increase over the 1,698,000 pounds imported from that source during the first half of last year.

A more optimistic report is seen for rotenone, largely due to the passing of seasonal demand. However, imports expected to arrive in June failed to materialize; a situation which is reminiscent of last year's rotenone events. In July, reports from Belem, Brazil, indicate 1,290,000 pounds of cube were shipped to the United States. This, added to the already heavy imports received in the U. S., should help greatly in alleviating shortages. Receipts at American ports during the first half of this year totaled 2,657,000 pounds, a rise of 82 per cent over the same period of last year.

Although production of DDT this year has increased 43 per cent over the corresponding period of 1945, supplies are currently far below demand. It is reported that anticipated production from now until the end of the year is already under contract for sale. Part of the unusual demand is said to lie in the fact that large quantities are being used in big-scale applications by various municipalities, park commissions, and other outlets heretofore insignificant as users of insecticide. Output of DDT for the first half of 1946 was 21,853,000 pounds.

Supplies of arsenicals appear to be in fair condition, although calcium arsenate remains in a tight position with demand for control of cotton insects heavy. This insecticide, important to the cotton belt, enjoyed a June output or 4,116,000 pounds (which was 29 per cent above that of May), and a six month total output of 14,098,000 pounds for the first half of 1946. Although this was but slightly less than the same period of 1945, higher export requirements and a heavy boll weevil infestation increased demand well above last year's figures. Exports of calcium arsenate during June totaled 98,000 pounds against 53,000 pounds during May. The first half of 1946 saw exportation of 3,153,000 pounds with France as the major destination. This was a considerably greater total than during the same period of last year when 1,557,000 pounds were exported.

Supplies of lead arsenate are now of sufficient quantity to meet current demand, now that the season of peak use is past. Reflecting increased prices in copper and lead, major ingredients in this insecticide, OPA has granted an increase of 10 per cent on manufacturers' ceilings on lead arsenate, and of 5 per cent on paris green. (Such increases will be passed on to the consumer.) The usual seasonal decline in output of lead arsenate is seen in June's production (5,091,000 pounds) which was 35 per cent less than that of May. However, despite shortages of both lead and arsenic, output of the insecticide during January to June amounted to 44,555,000 pounds; only 7 per cent less than production during the corresponding period of 1945.

Exports of lead arsenate in June were far under those of the previous month. (87,000 pounds as compared to 527,000 pounds in May) Nearly half of June's exported lead arsenate went to the Union of South Africa, while Cuba and Argentina were the chief destinations for much of the total export tonnage of the first six months of the year. This total was 1,527,000 pounds, only slightly less than the 1,622,000 pounds exported during the same period of 1945.

Inventories of copper sulfate appear to be on the increase, now that raw materials are once more available and production of the insecticide is back to normal. Despite strikes which for a time curtailed domestic production, exports of the material totaled 42,428,000 pounds against 23,750,000 for the same period last year. June exports were 3,981,000 pounds, slightly above that of the previous month. Of the June export total, 3,010,000 pounds were destined for Guatemala for protection of the banana crop there. Exports during earlier months of this year went largely to central European countries for protection of vineyards.

Also reported to be in 'easy supply" are petroleum oil sprays, exports of which in June totaled 274,000 pounds which was high for any month this year. Total exports during the first six months were 1,498,000 pounds, with major destinations including Palestine, Canada, New Zealand and the Union of South Africa.

Paradichlorobenzene supplies are showing a slight improvement over previous months of the year. Exports for the first six months of the year totaled 729,000, nearly three times the amount which went out dur-

ing the corresponding period of 1945.

Nicotine remains the darkest part of the insecticide picture, with production lagging considerably behind demand. June exports of nicotine sulfate totaled 12,000 pounds, against 5,000 in May. China was the destination of about half of the June shipments. The first half of 1946 saw only 84,000 pounds being exported as compared to 252,000 pounds in the same period of 1945.

Fertilizer Situation

THE fertilizer picture is somewhat different than it appears during the course of a normal year. Due to a number of factors, tax tag sales in the 16 states covered by a U. S. Dept. of Commerce report were unusually high for July, a month in which they have ordinarily been the lowest of the year. Heavy increases in states where last year's fertilizer sales were low had a great deal to do with the total expansion. Another contributing factor is a reaction from the inability to get all the fertilizer needed last spring.

Government "borrowing" of nitrogenous fertilizers is being done at this time when it is calculated to cause a minimum of dislocation to the industry. It is planned to repay the loan, beginning next January, out of production from the ordnance plants being readied for operation by the War Department. June's output of byproduct ammonium sulfate amounted to 54,040 tons, an improvement of 70 per cent over that of the preceding month which was hampered by the coal strike. June's production was still 16 per cent below that of the same month last year, and the total for the first six months of this year was some 167,000 tons below production of the same period last year. Output of synthetic ammonium sulfate also dropped in June. Production was 6,619 tons, or 22 per cent below that of the preceding month.

The supply of ammonium sulfate available to agriculture from domestic byproduct and synthetic production during the 1945-46 fertilizer year was equivalent to approximately 150,000 tons of nitrogen and about 12 per cent below the goal for the year. The aim for 1946-47 has been lowered to an equivalent of 143,500 tons of nitrogen. However, anticipated increases indicate a total fertilizer nitrogen production goal (including organics) 8.5 per cent ahead of the 563,580 tons set for the current year.

Falling to the lowest point of any month during the 1945-46 fertilizer, June production of superphosphate, 565,670 tons (basis: 18% P_2O_5) was an 8 per cent drop from the previous month. Production of concentrated superphosphate (basis: 45% P_2O_5) was better than a year ago, but was below that of the preceding month. An over-all view of the 1945-46 fertilizer year, production of normal superphosphate amounted to 7,582,887 tons, concentrated superphosphate, 281,625 tons and wet bas goods, 46,859 tons.

Phosphate Rock Coming

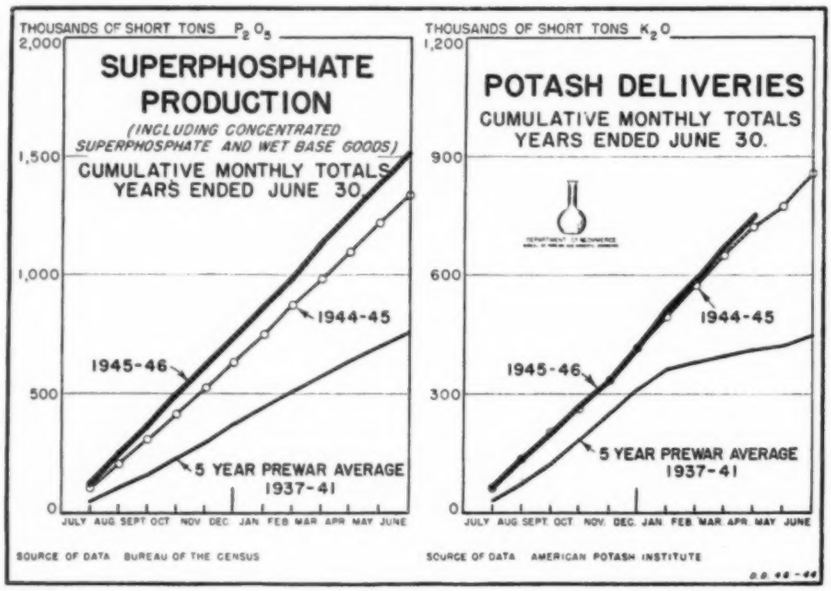
ALTHOUGH every effort is being exerted by the phosphate rock industry to meet heavy demands, some delay in shipment is bound to occur. Necessary materials for expansion or repair facilities for production of phosphate rock are being delivered to some producers which should ease the general supply situation. Exports of phosphate rock in June were maintained near the level prevailing in preceding months of this year. The only import of phosphate in June consisted of a shipment from Curacao of 2,475 long tons.

Potash appears to be short for the coming year: to the extent that the civilian Production Administration states that the supply will meet only 60 per cent of the requests. Under the CPA potash allocation system, established fertilizer firms will get about the same quantities of potash used last year with the increase going to new consumers. Prices for 1946-47 will probably remain at about the same scale as prevailed during the past year.

Imports of fertilizer and fertilizer materials were down during the past season, while exports exceeded by far those of the previous year. As a matter of fact, the 1945-46 exports were 71 per cent greater than during the previous year. Larger exports of nitrogenates, especially ammonium nitrate, as well as phosphate rock and superphosphates were chiefly responsible for the increase. In value, imports decreased 15 per cent and exports increased 73 per cent.

The charts below present a graphic picture of how greatly production and deliveries of plant food products have increased over the years immediately preceding the war. Sources: U. S. Bureau of Census and American Potash Institute.

Increase of Fertilizer Production in U. S.



(*Continued from Page* 50)

cluding the alums and organic acids (table 1).[7]

Materials found to give rise to positive electrostatic charge are predominantly alkaline materials or materials which expose lattice OH— groups on fracture. The most plausible explanation of the origin of the positive charge is frictional loss of OH— groups and thus an accumulation of a residual (+) charge. An alternative postulate is that a few scattered electrons are lost by frictional contact which would give rise to a positive charge is not considered tenable.

The positive charge is associated with such materials as hematite, goethite, gypsum, and epsom salt which are not particularly alkaline, but which may carry alkaline impurities or expose OH– or O = ions in their lattices which are capable of losing electrons. A positive charge is also associated with various ground and dried vegetable tissues. Several of the positively charged materials tested are known to yield alkali cations at surfaces on fracture, for example, Na+ exposed in ground albite, and K+ in ground mica (AA mica). These cations may act as alkalies by being supplied with OH– ions through a hydrolysis reaction with moisture from the atmosphere.

These postulates agree with the findings of Davy (3) that acid powders produce a (+) charge on a metal plate, if the metal plate (+) is considered to act as a condenser plate and bear a charge opposite to that of the acid power (—); and conversely for the (—) plate charge found with alkaline powders (+). It also agrees with Rudge (10) who found $CaCO_3$ (alkaline) to be (+) and silica (acid) to be (—).

Discussion

The electrostatic charge of quartz crystals and its effectiveness in insecticidal dust mixtures was usually greater when the material was freshly ground than after aging for a period of a few months. For example, one quartz dust with a charge, when fresh, of 14,000 volts showed a charge, after ageing of only 5,000 volts. The surfaces freshly formed by fracture bear active silicon-oxygen bonds which probably undergo hydrolysis in contact with air with its usual moisture content, according to the following reactions, wherein the O= and OH— ions are freshly exposed by crystal fracture:

$$\begin{matrix} \text{Si} \\ \text{O} \\ \text{Si} \end{matrix} + H_2O \rightarrow 2 = \text{Si—OH} \quad \text{and}$$

(Partial hydration)

$$\text{Si} = \text{O} + H_2O = \text{Si}\begin{matrix} \text{OH} \\ \text{OH} \end{matrix}$$

(Silicic acid)

Freshly ground quartz is distinctly acidic in reaction, thus indicating some dissociation of H^+ ions from these surfaces. At this early stage the quartz normally is electrostatically very active, and is an efficient dispersant. Gradual further hydration of the quartz surface, to form a gelatinous film of colloidal silicic acid is considered the probable cause of decreased electrostatic activity of the aged material. This silicic acid film, probably extending to a depth of a few atomic layers, would be expected to have a mechanical masking effect comparable to that of coatings by fine particles already mentioned. In addition, this colloidal silicic acid may cause some deactivation of the toxic constituents of the dusts by chemical action or physical adsorption. Such action is well illustrated with bentonite dusts which, though somewhat active electrostatically, bring about almost total deactivation of rotenone and certain other toxic agents. The presence of certain kinds of impurities may lead to variable results with powdered quartz; one sample did not produce measurable charges with any particle size.

TABLE 2

The effect of screen size on the development of electrostatic charges in dust clouds.

	Screen size	*Charge*
Limonite Ala.	100	0
Limonite Ala.	200	+ 3500
Limonite Ala.	325	+ 3800?
Limonite N. C.	100	+ 2000
Limonite N. C.	200	+ 4850
Limonite N. C.	325	+ 5000
Goethite	100	+ 500
Goethite	200	+ 1500
Goethite	325	+ 2200
Steatite Talc	100	+ 4500
Steatite Talc	200	+ 4200
Steatite Talc	325	± 0
Brucite	60	+ 2700
Brucite	100	+ 2200
Brucite	200	0
Brucite	325	0
Wisconsin Talc	60	—14000
Wisconsin Talc	100	— 9100
Wisconsin Talc	200	— 7560
Wisconsin Talc	325	— 5800
Pyrophyllite	100	—14000
Pyrophyllite	200	—10000
Pyrophyllite	325	— 5500
Silica Crystals	Over 60	0
Silica Crystals	60	— 200
Silica Crystals	100	— 2500
Silica Crystals	140	— 4000
Silica Crystals	200	— 4000
Silica Crystals	300	— 9600
Silica Crystals	325	—14000

With talc and pyrophyllite (and "Pyrax") powders, basal cleavage and exposure of silicious surfaces predominates with 100 mesh particles and high negative charges are found (Table 2). The pyrophyllite (—) charge passes through a maximum at 200 mesh size. Further grinding of these minerals may involve breakage through the crystal plates and exposure of the central brucite-like layer containing basic cations and OH– groups. These materials then show a marked decline in charge such as would be expected with a physical admixture of brucite (+). These minerals thus are "silica-like" at first but show a breakdown of charge much more quickly than quartz with a given mesh size.

Chlorites and micas have structures fundamentally analogous to pyrophyllite and talc except for the presence of the basic constituents $(Mg_2AlOH_6)^+$ and K^+, respectively between the crystal plates. On grinding they give rise to alkaline reactions immediately and do not go through the initial stage of (—) charge. Considerable variability occurs in the degree of (+) charge obtained from

[7] In accord with modern theory of the solid state. See T. B. Loeb, "The Basic Mechanisms of Static Electrification." Science 102:573-576, 1945.

different mica samples, but a charge up to (+)7600 volts was found with one mica. Chlorites are so easily fractured that an excess of fine particles prevents the development of an appreciable charge at any stage of preparation. However, talcs even though containing appreciable chlorite impurity often give a (—) charge with an optimum amount of grinding (cleavage along 001 planes of talc).

The reversal of the silicates albite, almandite, hornblende, and rhodonite from slight (+) charge when used alone to a (—) charge when mixed with "Pyrax" (—) seems to indicate neutralization of their alkalinity and an uptake of the basic surface cations by the silicic acid surfaces of the quartz particles contained in the "Pyrax" powder.

Summary

A MECHANISM involving electrostatic induction of a charge on the plant is postulated to explain the way in which the electrostatic charge on the dust particles of insecticidal dusts influences the distribution and adherence of the dusts to plants and insects.

To obtain further information on the charge of insecticidal dusts, a study was made of a wide variety of materials which have been included in these dusts. It appears that electrostatic properties are controlled by two general sets of factors: First, are the mineralogical characteristics such as hardness, type of cleavage, ease of fracture, and type of crystal habit (whether fibrous, prismatic, etc.) which affect the particle size distribution; and second, the chemical constitution and lattice structural arrangements which determine the acid or alkaline reaction. Excessive coarseness (>60 mesh) or fineness (<2u) was found to reduce or prevent charge development. Within the favorable size range negative electrostatic charges were found with acidic materials, and notably among the silicates with quartz, talc, and pyrophyllite which on cleavage or fracture expose SiO_2 tetrahedral structures.

Positive electrostatic charges were found with alkaline materials or those silicates which on cleavage or fracture yield alkaline cations or hydroxyl lattice structural groups at surfaces. This relationship may be viewed as a loss of protons from acidic and loss of hydroxyl ions from alkaline surfaces.

The electrostatic charge found with the various minerals agrees well with that expected from the above generalizations coupled with a knowledge of their crystal lattice constituents, arrangements, and cleavage characteristics.

It is believed that information on the electrostatic behavior of minerals will aid in proper selection of effective materials for use in insecticide dusts, and place the selection on a less empirical basis.★★

2, 4-D

2,4 Dichlorophenoxyacetic Acid

and

Sodium Salt

DDT

MFGR.

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THE VANDERBILT LABORATORY

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ABB FOR DDT

CHEROKEE CLAY for WET SPRAY

VEEGUM for SPRAY STICKER

PYRAX ABB

Universally used with DDT and all Dusts

CHEROKEE CLAY

For Sprays—Stays in Suspension longer

VEEGUM

In Wet Sprays—a Sticker of proven value

•

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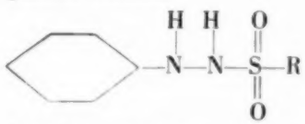
Industry Patents

No. 2,405,743. INSECTICIDAL COMPOSITIONS. Patent granted August 13 to Samuel I. Gertler, Washington, D. C., assignor to the United States of America as represented by the Secretary of Agriculture and his successors in office. An insecticidal composition comprising a compound of the general formula



in which R is selected from the group consisting of phenyl and tolyl radicals, incorporated in a carrier selected from the group consisting of a mixture of dust and a sticking agent and a mixture of a dust, a wetting agent and water.

* * *

No. 2,405,775. INSECTICIDE AND FUNGICIDE. Patent granted August 13 to William E. Bradley, Los Angeles, Calif., assignor to Union Oil Co. of California, Los Angeles. A process for the treatment of areas infested with fungus and insects, which comprises spraying said areas with a material comprising a substantially pure isoparaffinic oil boiling in the range of about 350° F. to about 800° F.

* * *

No. 2,405,824. FERTILIZER DISTRIBUTOR. Patent granted August 13, to Hermann E. Grether, Camarillo, Calif. A fertilizer distributor comprising a hopper having outlets in the bottom of the sides thereof, a bottom for the hopper, means for rotating the bottom relatively to the hopper, said bottom presenting peripheral recesses cooperating with the sides of the hopper to form pockets adapted to be filled with fertilizer from within the hopper and which are consecutively brought into registration with the hopper, and spring actuated means urged into engagement with the walls of the hopper and the bottom for covering the pockets after they pass into and out of registration with the outlets.

No. 2,406,294. INSECTICIDE. Patent granted August 20, 1946 to James W. Hansen and Carroll C. Cassil, Berkeley, California, assignors to California Spray-Chemical Corp., Richmond, Calif. An insecticidal composition as active toxic ingredient cyclopropyl furyl propenone and a carrier therefor.

* * *

No. 2,407,041. INSECTICIDE. Patent granted September 3, 1946, to Benjamin H. Thurman, Charlotte, N. C., assignor by mesne assignments, to Benjamin Clayton, Houston, Tex., doing business as Refining, Unincorporated. An insecticide of the stomach poison type consisting essentially of an aqueous dispersion of a crude vegetable oil phosphatide and a stomach poison comprising a finely divided slightly water soluble compound selected from the group consisting of arsenates and arsenites of polyvalent metals, the proportions of phosphatide and polyvalent metal compound ranging between approximately 1 part phosphatide and 2 to 8 parts polyvalent metal compound.

* * *

No. 2,407,205. INSECT REPELLENTS. Patent granted September 3, 1946, to Benjamin G. Wilkes, Wilkinsburg, Pa., assignor to Carbide and Carbon Chemicals Corp. A method of repelling insects which includes applying to a zone to be treated an insect repellent comprising as an essential repellent ingredient thereof 2-ethylhexanediol-1,3.

* * *

No. 2,407,333. FUMIGATION METHOD. The method which comprises fumigating a space wherein the principal known living things subject to destruction by fumigation are micro-organisms, with a lethal concentration in air of a toxicant selected from the group consisting of 2-bromo-2-methyl propane and 2-ido-2-methyl propane. Patent granted September 10 to Peter R. Wenck and Walter A. Henson, Midland, Mich., assignors to the Dow Chemical Company.

•

"Flying Farmers" Meet

Crop dusting, seeding and spreading of fertilizer from an airplane were demonstrated at a "flying farmers" field day at Purdue University, Lafayette, Ind., recently, the exhibition being staged by the Safe-Way Co., commercial plane operators of Decatur, Ill.

Another application of airplane use in agriculture was seen recently when the DeKalb Agricultural Association, Inc., a cooperative organization of farmers at De Kalb, Ill., used four planes to dust 6,000 acres of hybrid seed corn with DDT. Local authorities claimed this was the first large scale use of DDT from the air against the European corn borer.

•

Fertilizer Plant Sold

Purchase of the Government-owned nitrogen plant at South Point, Ohio has been announced by the Solvay Process Co., subsidiary of Allied Chemical and Dye Corp., New York.

COMMENTS

(*Continued from Page* 51)

problems. They were taken to China by UNRRA.

I am in communication with the Bureau of Science, Department of Agriculture and Commerce, Commonwealth of the Philippines, and with Dr. J. Linsley Gressitt who, after spending part of the war years in China, was later repatriated to the United States. Subsequently, Dr. Gressitt received his Doctor's degree in entomology at the University of California and has recently returned to the staff of Lingnan University, Canton, China. I shall be glad to receive correspondence with respect to both the Philippines and China, or Dr. Gressitt will be glad to receive communications on the general subject and to communicate with other institutions in China. The Smithsonian Institution and the office of the Philippine Resident Commissioner at Washington, D. C., or the branch office in San Francisco, will receive contributions for the Bureau of Science in the Philippine Islands.

New Trade Marks . . .

Application has recently been made to the U. S. Patent Office for registration of the following trade-marks for products in the agricultural chemical field, and the marks listed were published in August and September issues of the OFFICIAL GAZETTE. The Patent Office requires that notice of any opposition to registration of a trade-mark be filed within thirty days of publication in the GAZETTE, accompanied by a fee of ten dollars.

Trade Mark Applications

VICTOR, in capital letters. For poisons for insects, rodents, and other pests. Filed March 27, 1946 by Animal Trap Company of America, Lititz. Pa. Claims use since Feb. 11, 1946.

EVERCIDE, in capital letters slanted upward. For Insecticides. Filed March 28, 1946, by McLaughlin Gormley King Co., Minneapolis, Minn. Claims use since March 8, 1946.

IDEAL HOG-KOTE, in capital letters. For medicated hog oil for treatment of hogs to kill lice, mange, and other diseases. Filed July 13, 1945 by Central Petroleum Co., Cleveland. Claims use since Dec. 1, 1942.

TAG, in tall capital letters for parasiticides, namely, insecticides, fungicides and germicides, spray adjuvants, herbicides and compounds which influence specific physiological processes in plants. Filed Jan. 29, 1946, by California Spray-Chemical Corp., Richmond, Calif. Claims use since Dec. 18, 1945.

VELSICOL, in stencil-type capital letters. For insecticides and fungicides. Filed Apr. 3, 1946, by Velsicol Corp., Chicago. Claims use since September, 1940.

1068, in stencil-type capital letters. For insecticides and fungicides. Filed April 3, 1946 by Velsicol Corp., Chicago. Claims use since Feb. 11, 1946.

VELSICOL, white capital letters on black background, with "V" motif and circle behind word, for insecticides and fungicides. Filed April 3, 1946, by Velsicol Corp., Chicago. Claims use since September, 1940.

WEEDEX, in capital letters to simulate weed stems. For chemical preparations for exterminating weeds. Filed April 4, 1946 by American Chemical Paint Co., Ambler, Pa. Claims use since Aug. 10, 1931.

TREAT, in sans serif capital letters, for food for roses and plants. (Fertilizer) Filed Feb. 7, 1946 by Sherwood Mortley Pinkerton, doing business as S. Pinkerton, Toledo, Ohio. Claims use since May 15, 1936.

S K P, in block capital letters. Preparation for the treatment of internal disorders of stock. Filed February 15, 1946, by Dr. Hess & Clark, Inc., Ashland, Ohio. Claims use since Jan. 7, 1946.

TWIN-8, in sans serif capital letters, for chemical products for use in combatting insects and fungi. Filed March 16, 1946, by Monsanto Chemical Co., St. Louis. Claims use since Feb. 11, 1946.

FLO-GRO, in yellow letters on red background, for fertilizers. Filed Aug. 2, 1945, by Growers Service and Supply Co., Yakima, Wash. Claims use since March 1, 1945.

A RECTANGULAR TRADE MARK in various colors for a mild astringent and a drinking water bacteriostat for poultry, vaccines for poultry and domestic animals, vermifuge for domestic animals, insecticide, control for cannibalism in poultry, and fumigant. Filed Apr. 12, 1945 by Dr. Salisbury's Laboratories, Charles City, Iowa. Claims use since July 9, 1935.

A BOUQUET OF FLOWERS IN A VASE, trade mark for composition containing chemical ingredients for strengthening, sterilizing, feeding and promoting the development of cut plants and adapted to be added to water in which the plants are immersed. Filed May 11, 1945, by Flower Foods, Inc., Maywood, Ill.

OE ENDICOTT, in signature form, for preparation for the treatment of hogs for thump, worms, loss of appetite, scours and after effect from cholera vaccination. Filed Aug. 17, 1945 by Richard T. Endicott. Paunee, Oklahoma. Claims use since January, 1944.

TIMSOL, in heavy capital letters, for liquid compound used as a disinfectant, germicide, fungicide, and deodorant. Filed Feb. 23, 1946, by Theo. Ross, doing business as Theo. Ross Associates, a division of Timsol Company of America, Los Angeles. Claims use since Feb. 4, 1946.

RID-O-SECT, in capital letters, for insecticide. Filed March 7, 1946, by M. J. Bennett & Co., New York. Claims use since Feb. 20, 1946.

POLY-BLOOM, in sans serif capital letters with drawing of flower between words. For concentrated plant food and fertilizer. Filed April 13, 1945 by the Poly-Bloom Co., Brooklyn, N. Y. Claims use since March 13, 1945.

Trade Marks Granted

422,986. GARDEN MULCHES USED AS PROTECTIVE COVERING FOR PLANTS, ROOTS AND BULBS. Filed October 1, 1945, by Larrowe Mills, Inc., Cohocton, N. Y.

423,016. ANTHELMINTIC AND ANTIBACTERIAL PREPARATION. Filed Nov. 2, 1945, by Sharp & Dohme, Inc., Philadelphia.

423,021. INSECTICIDES ADAPTED FOR SPRAYING ANIMALS. Laboratory Products Corp., New York. Filed Nov. 9, 1945.

423,024. INSECTICIDES, FUNGICIDES AND DISINFECTANTS. Rohm & Haas Co., Philadelphia. Filed Nov. 13, 1945.

423,043. INSECTICIDES. Tom Huston, doing business as Tuff Stuff Insecticides, Miami, Fla. Filed Dec. 5, 1945.

423,225. POULTRY LOUSE KILLING OINTMENT. Filed June 27, 1945, by The Pormac Co., Bowling Green, Ky.

423,264. PARASITICIDES — NAMELY, INSECTICIDES AND FUNGICIDES; SPRAY ADJUVANTS, HERBICIDES AND COMPOUNDS WHICH INFLUENCE SPECIFIC PHYSICOLOGICAL PROCESSES IN PLANTS. California Spray-Chemical Corp., Richmond, Calif. Filed Nov. 6, 1945.

Classified Advertising

Rates for classified advertisements are ten cents per word, $2.00 minimum, except those of individuals seeking employment, where the rate is five cents per word, $1.00 minimum. Address all replies to Classified Advertisements with Box Number, care of Agricultural Chemicals, 254 W. 31st St., New York 1. Closing date: 1st of month.

Organic Chemist, Ph. D., extensive experience in manufacture and formulation of DDT and 2,4-D, 12 years experience in developmental research with successful record in conducting new processes for fine and heavy organic chemicals from laboratory through pilot plant into commercial production desires responsible position with progressive organization. Substantial background in synthetic medicinals and pharmaceuticals. Age 36, married. Address Box 118, care of *Agricultural Chemicals.*

Sales Agent — Established organization in Hawaii desires to represent manufacturers of insecticide and disinfectant specialties, sprayers, detergents, and other chemical products as exclusive sales agent in that territory. Both small package goods and industrial sizes. Write to Box 119, care of *Agricultural Chemicals.*

For Sale — Lot to close out stock, 20,000 cases of pints of five per cent DDT in oil with knockdown agent and perfume. Priced right for immediate sale. For further details, write to Box 120, care of *Agricultural Chemicals.*

DDT Liquid—For sale in carloads of drums or less guaranteed 25 per cent DDT water miscible liquid, all p,p DDT, approved formula, filtered, ready for dilution and use. $2.15 gal. carloads fob Chicago. For information, write to Box 127, care of *Agricultural Chemicals.*

Salesman—Available top flight salesman thoroughly acquainted with the agricultural industry throughout the United States. Write to Box 122, care of *Agricultural Chemicals.*

Entomologist and Plant Pathologist—Veteran, 26, BS degree in Recreational and Municipal Forestry from Michigan State College. Training in Botany, Plant Pathology, and Entomology. Experience in diagnosis of plant diseases, insect damage and spraying of trees and shrubs. At present employed by nursery selling stock and diagnosing ornamental plant troubles. Write Box 123, care of *Agricultural Chemicals.*

Three Veterans—Age 27 to 30 years, 2 chemical and 1 mechanical engineer, 15 years collective engineering and sales experience in industry, desire connections with reputable manufacturers for sale and distribution of Agricultural Chemicals and related lines in Wisc.-Minn.-Dakota territories. References & Qualifications furnished upon request. Write Box 124, care of *Agricultural Chemicals.*

Sales Representatives for Ohio, Michigan, Indiana, Texas, Louisiana and California. Wanted by well known manufacturer. Agricultural sales experience desired. Considerable travelling will be necessary. Give full details, experience, salary desired to Box 125, care of *Agricultural Chemicals.*

Manufacturers' Representatives —Wanted to sell old established agricultural insecticide line to seed, hardware and drug jobbers. Territories now being organized for such representation to replace direct company selling. Please give complete pertinent information in first letter. Address Box 126, care of *Agricultural Chemicals.*

Wanted — Agricultural Chemicals. Nitrogen - Liquid Phosphoric. Acid - Potash - Insecticides. Write Karl Ahlswede, Estb. Fertilizer Mfr., P. O. Box 81—Arlington—California (Riverside County).

ALVIN J. COX, Ph.D.
Chemical Engineer and Chemist

(Formerly Director of Science, Government of the Philippine Islands; Retired Chief, Bureau of Chemistry, State of California, Department of Agriculture.)

ADVISOR ON AGRICULTURAL CHEMICAL PROBLEMS AND INVESTIGATIONS

Consultant in reference to spray injury and damage, claims, including imports of fruits and nuts, formulas, labeling, advertising and compliance with law.

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". . . and don't mention loafin' to de production department no more!"

Big push . . .

IF economic signs do not fail, the time is not far distant when the big sales push will be on again, when goods will not be moving out of warehouses faster than they go in, when a good order will command a little respect, and when a new customer will not be a nuisance. If you are planning for your big sales push when the time comes, and your push includes the field of agricultural fungicides, insecticides, weed killers, rodenticides, fertilizers and other chemicals for agriculture, consider now regular advertising in

AGRICULTURAL CHEMICALS
254 WEST 31st STREET NEW YORK 1

TALE ENDS

APHIDS descending in large windborne swarms upon the baseball field and stands in Brooklyn last month forced the ending of a game between the Chicago Cubs and the famous "Bums." Inasmuch as this happened in Brooklyn,—where anything can happen,—it is not so unusual. The unique feature of the invasion was the fact that the owners of the "Bums" sprayed their field and stands the next day,—according to the papers,—so that this would not happen again. And to add the magic touch in their unique means of keeping the wind from blowing in future insect invaders, they announced that the spraying had been done with DDT!

•

Sharp-eyed readers of Agricultural Chemicals arose last month to inform us that we may be experts in agronomy, but not in astronomy. In the article by Dr. A. J. Cox on page 45, the statement is made ". . . It is only to the eye that the changes in the moon appear, for the moon revolves about the earth each day . . ." Our critics point out that the moon goes around the earth one time every 27 days and eight hours, and that we would have a badly-mixed up state of affairs if it tried to speed up the process.

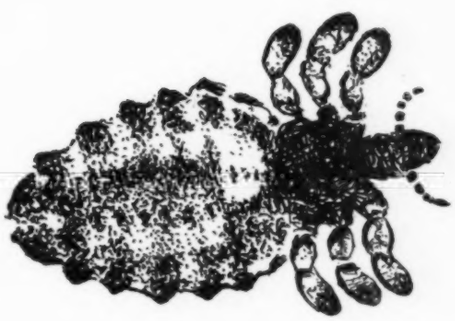
•

Following a spraying of Philadelphia's Municipal Stadium with DDT prior to a night football game, some 90,000 spectators had their first experience at sitting through a mosquito-less evening on September 13. Spraying was done by the Accurate Tool Company's airplane-propellor device which covered the surrounding area in short order. Walter Walker, developer of the machine, was at the controls.

•

The Japanese are reported to have developed a substitute insecticide during the war, to replace petroleum base pyrethrum insecticides formerly used for control of rice leafhoppers. The substitute was patented in 1943, when supplies of kerosene were almost non-existent.

CATTLE LOUSE



BUG OF THE MONTH

PRENTISS FOR PEST-TESTED *Basic Insecticides*

Cattle Lice—the short nosed cattle louse, long-nosed cattle louse, and biting louse—all obtain their food from the tissues of cattle and can seriously retard the weight increase of steers, and lower the milk production of dairy cattle. Preliminary tests in 1945 indicate that DDT formulations are highly effective against these pests. Prentiss offers three basic DDT mixtures for use in your products for the control of cattle lice and other livestock pests—*Prentiss Micro-Mesh Wettable* (50% DDT Powder with average particle size of 2.5 microns), *Prentiss 30% DDT Oil Concentrate*, and *Prentiss 25% Water Miscible DDT Concentrate*.

We also have ample stocks of finely milled and uniformly batch mixed *Cube Powder* to make time-tested Rotenone sprays and dusts for Cattle Louse control.

Other Prentiss basic insecticides include:

(1) *Prentiss Micro-Mesh Dry*—a 50% DDT powder for blending in agricultural dusts—milled to an average particle size of 2.5 microns.

(2) *Prentiss #10 Concentrate*, a liquid concentrate containing 50% by weight of mixed DDT isomers, for use in manufacturing residual insecticides containing DDT isomers.

(3) *Prentiss Pyrethrum Powder*—Finely ground and specifically adapted to agricultural dusts containing pyrethrum.

Look to Prentiss for a dependable source of supply on agricultural insecticide raw materials and intermediate products.

R. J. PRENTISS & COMPANY, INC. • **110 William Street, New York 7, N. Y.**

9 So. Clinton Street, Chicago 6, Illinois — Plants: Brooklyn, New York and Newark, New Jersey

PRENTISS

RAW MATERIALS FOR AGRICULTURAL INSECTICIDES

Attention - AGRICULTURAL INSECTICIDE FORMULATORS!

LET

Solve Your DDT Problems

As a superior solvent and co-toxicant for DDT in agricultural insecticide formulations VELSICOL AR-60 is the answer to many difficult problems. Its use assures maximum efficiency and performance, for your dust and spray formulations.

DDT *residues?* AR-60 is an effective toxicant in itself to a wide range of plant pests. It enhances the efficiency of DDT insecticides; permits lower concentrations of DDT and thus excessive DDT residues are avoided.

Corrosion? AR-60-DDT formulations are non-corrosive.

Low temperature stability? AR-60-DDT liquid formulations are stable at low temperatures, eliminating crystallization hazards.

Phytotoxicity? AR-60 is safe within recommended limits. When used to 60% by volume of the mixture, liquid formulations employing AR-60 are safe on most plants when used with suitable emulsifiers and wetting agents; AR-60-DDT dust formulations are safe on plant foliage up to 3% AR-60 by weight.

Emulsifiability? AR-60 is readily emulsified resulting in maximum efficiency from the emulsifiers and wetting agents employed.

Water Solubility? AR-60 is insoluble in water.

Samples and complete technical data about AR-60 and the other VELSICOL Methylnaphthalenes are available on request.

VELSICOL Corporation

• *Manufacturers of: Insect Toxicants • Synthetic Resins • Coresin Core Oils • Aromatic Solvents*

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